SCIENCE

A WEEKLY JOURNAL DEVOTED TO THE ADVANCEMENT OF SCIENCE, PUBLISHING THE OFFICIAL NOTICES AND PROCEEDINGS OF THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.

EDITORIAL COMMITTEE: S. NEWCOMB, Mathematics; R. S. WOODWARD, Mechanics; E. C. PICKERING, Astronomy; T. C. MENDENHALL, Physics; R. H. THURSTON, Engineering; IRA REMSEN, Chemistry; CHARLES D. WALCOTT, Geology; W. M. DAVIS, Physiography; HENRY F. OSBORN, Paleontology; W. K. BROOKS, C. HART MERRIAM, Zoology; S. H. SCUDDER, Entomology; C. E. BESSEY, N. L. BRITTON, Botany; C. S. MINOT, Embryology, Histology; H. P. BOWDITCH, Physiology; J. S. BILLINGS, Hygiene; WILLIAM H. WELCH, Pathology; J. MCKEEN CATTELL, Psychology; J. W. POWELL, Anthropology.

FRIDAY, OCTOBER 18, 1901.

CONTENTS:

The American Association for the Advancement of Science:—
Section B (Physics): PROFESSOR JOHN ZELENY 585
Section G (Botany): DR. ERNST BESSEY..... 596
Membership in the Association..... 602
Address of the President of the Anthropological Section of the British Association for the Advancement of Science, I.: PROFESSOR J. D. CUNNINGHAM..... 603
Scientific Books:—
Riemann's Die partiellen Differential-Gleichungen der mathematischen Physik: R. S. W. *Comstock's Text-book of Astronomy*: SIDNEY D. TOWNLEY..... 610
Scientific Journals and Articles..... 613
Societies and Academies:—
Section of Astronomy, Physics and Chemistry of the New York Academy of Sciences: DR. F. L. TUFTS. *The Elisha Mitchell Scientific Society*: PROFESSOR CHARLES BASKERVILLE..... 614
Discussion and Correspondence:—
An Institute for Bibliographical Research: AKSEL G. S. JOSEPHSON. *Discord*: PROFESSOR MAX MEYER. *A Correction*: WILLIAM J. FOX..... 615
Current Notes on Physiography:—
Mt. Ktaadn; Norwegian Fiords; The Origin of Moels: PROFESSOR W. M. DAVIS..... 617
The Phylogeny of the Toothed Whales: F. A. L..... 618
Anthropology at the University of California..... 619
Scientific Notes and News..... 620
University and Educational News..... 623

MSS. intended for publication and books, etc., intended for review should be sent to the responsible editor, Professor J. McKeen Cattell, Garrison-on-Hudson, N. Y.

THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.

SECTION B, PHYSICS.

THE officers of this Section were: Vice-President, D. B. Brace; Secretary, John Zeleny; Member of Council, E. L. Nichols; Sectional Committee, D. B. Brace, John Zeleny, B. W. Snow, L. B. Spinney, E. L. Nichols; Member of General Committee, L. B. Spinney.

A large number of papers of unusual importance was presented before the Section, so that a keen interest was maintained in the meetings to the very end. The authors of a number of the papers were absent but had representatives who were familiar with the subjects they presented, so that beneficial discussions were possible even in these cases.

On Thursday forenoon, August 29, the Section met with the American Physical Society, and on the afternoon of the same day there was a joint meeting of Sections A and B.

The following are the abstracts of the papers that were presented:

1. 'A Spectrophotometric Comparison of the Relative Intensity of Light from Carbon at Different Temperatures': ERNEST BLAKER.

The instrument used in this work was a Lummer-Brodhun spectrophotometer, the comparison source being an acetylene flame.

The carbon studied was that of the filament of the ordinary incandescent lamp with treated surface, on the one hand, and a similar filament with smoked surface on the other. Temperatures were computed by means of the empirical relation between them and the ratio of the resistances of the hot and cold filament, established by Chatelier. *

Isochromatic curves showing the rise in intensity with the temperature were plotted for various wave lengths of the visible spectrum. These, taken separately, exhibit the form characteristic of bodies previously investigated, such as platinum and the artificially produced 'black body.'

The temperature or its reciprocal as demanded by the received equations for radiation is nearly proportional to the logarithm of the intensity.

The corresponding isothermal curves, however, show the existence of the remarkable peculiarity noted by Nichols † in a recent paper. The selective radiation in the yellow, described by that author, is even more strikingly developed at the higher temperatures covered in these experiments. It exists alike in the case of the gray-surfaced carbon and in lamp black and would lead us to classify carbon rather with the metallic oxides than with the black bodies, as regards the laws of radiation.

2. 'The Distribution of Energy in the Spectrum of the Acetylene Flame': George W. Stewart.

The great value of acetylene not only for illuminating purposes, but also in experimental research, makes the study of the distribution of energy in its spectrum of considerable importance. In the work to be described, a mirror spectrometer and fluorite prism were used to produce the spectrum, and the radiometer of Nichols to measure the radiant energy. The mirror-prism device of Wadsworth was utilized, the main advantage gained being that the radiometer could be kept stationary. The spectrum fell upon a slit mounted directly in front of the fluorite window of the radiometer, thus avoiding the use of any lens whatever.

The source of light used in the work upon the visible portion of the spectrum was a cylindrical acetylene flame from a single-tip burner. This type was used because the intensity per unit area was greater than in the flat flame. The results, plotted in the form of a curve, afford definite data concerning the distribution of energy in the visible spectrum of this flame.

Owing to the difference in the dispersion of the prism, a slight change in the relative positions of the spectrometer and radiometer was of greater consequence in the infrared than in the visible portion of the spectrum.

The most striking characteristic of the curve of energy distribution is the set of elevations which are due to the emission bands of the gases of the flame. If the acetylene is pure, the gases to be expected are CO_2 and H_2O. According to Paschen, the maximum points of the emission bands of these gases are as follows:

H_2O Spectrum,
1.46μ, 1.90μ, 2.83μ.

CO_2 Spectrum,
2.71μ (2.68μ when CO_2 is not dry) and 4.40μ.

The energy curve shows elevations whose maxima agree very closely with these values. Observations of wave lengths longer than 6μ are useless, the error due to stray radiation being so great.

Similar measurements were made upon the flame of a bunsen burner adapted for the combustion of acetylene.

In this curve all five emission bands appear and the values of the wave length at the maximum points agree with the values

* Chatelier, *Journal de Physique* (3), I., p. 203.
† Nichols, *Physical Review*, Vol. XIII., 1901.

quoted above. If we compare the bunsen and the single tip curves, we see that they do not agree in all respects. The elevations due to the emission of the H_2O gas have not the same relative values in the two cases, but this discrepancy disappears when corrections are made for slit widths. The band at 2.3μ does not appear in the bunsen flame and this fact makes its presence in the other somewhat in doubt.

The changes produced in the correction of the curves possess several points of interest. The maximum of intensity is shifted considerably toward the violet, appearing in the corrected curve at about 0.94μ.

Using Langley's method of finding the ratio of the area in the visible portion of the spectrum, to the area of the entire curve, the radiant efficiency was calculated. The value for the cylindrical flame is 0.100 and for the flat flame 0.131. The latter value is not very reliable, but there is not much doubt but that the radiant efficiency of the flat flame is the larger. Stewart and Hoxie, using a modification of the Melloni method, found the value 0.105 for the flat flame. (To be printed in the *Physical Review.*)

3. 'Experiments on a New Form of Standard High Electrical Resistance': H. C. PARKER. (By title.)

4. 'Variation of Contact Resistance with Change of E. M. F.': H. C. PARKER. (By title.)

5. 'On Flutings in a Sound Wave and the Forces due to a Flux of a Viscous Fluid around Spheres': S. R. COOK, Washburn College.

The author shows that the forces due to a perfect fluid are not sufficient to produce the laminæ and flutings in a sound wave, but that there are other forces which are probably due to the viscosity of the vibrating media. That there must be other forces was first manifest by a series of experiments with air, carbon dioxide, chlorine and hydrogen as media, using various materials to form the laminæ, including filings of coin silver and platinum.

The author also shows that flutings are not confined to a stationary sound wave but are capable of being produced by direct sound waves on an open surface.

A mica disk, threaded on a fine wire in a resonance tube, was caused to vibrate in unison with the prong of a large tuning fork, whose frequency was 32 per second. Koenig's equations for the forces due to a perfect fluid when reduced to their final form are:

$$X = \frac{3/2\pi\rho R^3 R_1^3 W_0^3}{r_0^4}$$

$$Z = -\frac{3\pi\rho R^3 R_1^3 W_0^3}{r_0^4}$$

$$M = \rho R_2^3 W_0 \sin 2\theta.$$

ρ = density of medium, R, R_1, R_2 are the radii of the sphere or disks, W_0 the velocity of the stream. This gives repulsion parallel and attraction perpendicular to the stream lines. The forces were studied by first allowing RR_1 to vary while ρ and W_0 remained constant. Then ρ was varied while all other factors were kept constant, and it was shown that

$$\frac{X_1}{X_2} = \frac{Z_1}{Z_2} = \frac{M_1}{M_2} > \frac{\rho_1}{\rho_2}$$

when ρ_1 was the density of carbon dioxide and ρ_2 that of air.

A further study of the forces was made with sealing-wax spheres and it was found that when the spheres, whose radii were less than 1 mm. were at a greater distance than one-half their diameter apart, they followed the perfect fluid forces, but when they were less than one-half their diameter they were repelled perpendicular, and attracted parallel, to the line of flow.

The author reaches the following conclusions:

1. The conditions for the formation of laminæ are found whenever there is a flux of a viscous fluid around solid particles.

2. There are forces exactly opposite to those of the perfect fluid.

3. These new forces are most probably due to the viscosity of the medium.

4. The new forces in conjunction with the forces of a perfect fluid make possible a complete and clear explanation of the laminæ and flutings produced in a sound wave. (To be printed in the *Phil. Mag.*)

6. 'Interferometer Curves': J. C. Shedd, Colorado College.

The general equation of the interference curves is found to be a conic and the conditions for obtaining the various forms are determined by considering the question of eccentricity.

The various cases are taken up in detail and the experimental manipulations necessary for obtaining them are explained.

7. 'On the Absorption Spectrum of Iodine in Solution': Edward L. Nichols and William W. Coblentz.

That iodine dissolved in carbon disulphide, although opaque to the visible spectrum, transmits the infra-red rays freely, has long been known, but no systematic studies of the spectrum of such solutions appear to have been made. In the study of the visible spectrum a horizontal slit spectrophotometer was used. Quantities of iodine varying from 3.3 mg. to 0.017 mg. per cubic centimeter were dissolved and their absorption spectra measured. A single broad band was found, having its maximum at $\lambda = .52\mu$, the transmission curve being steeper on the side towards the violet. For the solution containing 0.017 mg. per cc. the transmission in the center of the band was 80 per cent. With increasing concentration the band widens and becomes more dense., Solutions containing more than .25 mg. per cc. are opaque in the center of the band, and the region of opacity extends as the amount of iodine in solution is increased until the entire visible spectrum is obscured. Observations upon iodine dissolved in alcohol showed a very different absorption spectrum. Such solutions were opaque in the violet, the transmission increasing steadily towards the red. The form of the curves was such as to indicate an absorption band of which one side only lies in the visible spectrum, the center being in the ultra-violet. To extend these measurements to the infra-red spectrum a Nichols radiometer was employed. Readings of the transmission of various solutions were made out to 2.7μ, beyond which wave-length the solvent itself rapidly becomes opaque. It was found that all solutions rose rapidly in transmitting power with increasing wave-length and became completely transparent between 1.0μ and 1.1μ, between which region and 2.7μ, iodine appears to exert no absorbing power whatever.

7a. 'A Preliminary Communication on the Pressure of Light and Heat Radiation': E. F. Nichols and G. F. Hull.

The experiment consisted of two parts: (1) The determination of the light pressure by observing the deflection, either static or ballistic, of a torsion balance when one vane of the balance was exposed to light, and (2) the determination, in ergs per second, of the intensity of the light falling upon the vanes. The image of an aperture, upon which the rays from an arc lamp were concentrated by two condensing lenses, was focused in the plane of the glass vanes placed symmetrically with regard to a rotation axis held by a quartz fiber of known torsion coefficient. The torsion balance was covered by a bell jar connected to pressure gauges and a mercury pump. To eliminate the disturbing action due to the residual gas in the receiver, the following devices were used: (1) The vanes were silvered and highly polished, thus making the absorption small and the reflection percentage large. (2) The silver surface of one vane was turned towards, and of the other, from,

the light, thus making the effect of the gas action and light pressure in the same direction on one vane, and in opposite directions on the other. (3) The pressure of the air in the bell jar was varied, and the pressures were chosen in the vicinity of that pressure at which the gas action was very small. (4) The length of exposure of light on the vane in most of the observations was short. The gas action, which begins at zero and increases with the length of exposure, was thus reduced in comparison with the instantaneous action of the radiation pressure. By means of an inclined glass plate placed in front of the aperture a portion of the incident light was thrown on a thermopile. The deflection of a galvanometer connected with the latter gave the *relative* light intensities.

Two methods of determining radiation pressure were used:

(1) The vane was exposed continuously to the light until the turning points of the vibration of the balance showed that static conditions had been reached. The other vane was then exposed. Finally the whole suspended system was turned through 180°, and the vanes were exposed in turn. The mean of the angles of deflection, multiplied by the torsion coefficient of the fiber and divided by the lever arm, gave the force in dynes acting on the vane. (2) The vanes were exposed for a quarter of the period of the suspended system. The period, damping coefficient, torsion coefficient and lever arm being known, the value of the radiation could be found. The two methods gave practically the same result except for the air pressures for which the gas action was large.

The energy falling upon the vanes was measured by means of a bolometer consisting of a thin disc of platinum, about the size of the vanes, covered with platinum black. The bolometer, occupying exactly the position which the glass vane had previously occupied, was made one of the arms of a Wheatstone bridge. The bridge was balanced, the bolometer exposed to the light, and the throw of the bridge galvanometer read. Later the disc was heated by an electric current which entered and left at two equipotential points on the bridge current and the galvanometer throw again was read. The current strength and the resistance of the disc being known, the activity of the disc is given by $i^2R \times 10^7$ ergs per second. The readings of the thermopile before mentioned made it possible to reduce all observations to a constant light intensity. If E = energy per second falling upon a surface, a = the percentage of the radiation reflected, v = the velocity of light, then, theoretically, the value of the radiation pressure is $\frac{(i+a)E}{v}$. The experimental value of the pressure as found by the authors was about 80 per cent. of the theoretical value.

8. 'The Absorption Spectrum of Ferric Hydrate': B. E. MOORE, University of Nebraska.

The author in a recent article upon 'A Spectrophotometric Study of the Hydrolysis of Ferric Chloride,' has pointed out that the final product is colloid ferric hydrate. This product can be formed by Graham's dialytic method. It would then be inferred that identical products would have identical absorption spectra.

It was found that the absorption of the two products was quite different in character. The addition of given quantities of chlorine or of hydrochloric acid, did not effect any transformation in the dialyzed colloid, *i. e.*, crystalloids, if present, were not changed by this treatment. If dialyzed ferric hydrate, or hydrolyzed ferric chloride were added to fresh dilute ferric chloride, the hydrolysis of the latter was accelerated. The greater acceleration was caused by the hydrolyzed ferric chloride. From this it is

inferred that both solutions contain identical colloids, but that the Graham's colloid contains also considerable inactive crystalloid hydrate. The absorption curve then suggests that the crystalloid has an absorption curve lying between hydrolized ferric chloride and non-hydrolized ferric chloride. (To be printed in *Physical Review.*)

9. 'Note on the Transmission of Radiation by Thin Films of Asphalt': E. L. Nichols.

10. 'The Faraday Effect in Solutions of Hydrolyzed Ferric Chloride': Fred. J. Bates, University of Nebraska.

The rotation of the plane of polarization in optical transparent substances, when the light is transmitted along the lines of magnetic force, has been the subject of numerous experiments since the days of Faraday, and is known as the 'Faraday Effect.' There have been many determinations of the molecular rotation of substances in solution, but little effort to determine whether the effect in solution arises from a molecule or from an ion or from both. Observations have also frequently been limited to one color (and perhaps then a mixed color), or to a few colors. It seemed desirable to extend these observations to different parts of the spectrum. This is particularly true of colored solutions, whose colors correspond hypothetically to the free periods of their vibrations, affecting the dispersion and probably the rotation of the plane of polarization.

Ferric chloride solutions afford a good means of testing this phenomenon. Observers have noted that the molecular rotation of this substance decreases upon dilution of the solution. This suggests that the rotation arises from the molecules rather than from the ions. The writer tried a solution of sufficient concentration to give him a rather large rotation. The solution was then diluted enough to leave the effect slightly but certainly noticeable. If the rotation was proportional to the concentration, no effect was observed, which suggests that the ions are inactive or possess very small rotary power in comparison to that of the molecules. Observations by Goodwin and Moore show that dilute solutions of ferric chloride hydrolyze and finally form a new product, colloid ferric hydrate. It was thought that by restoring an iron molecule by this process there would possibly be a small rotation where previous ionization had made it unobservable. By this test it was found that the required dilution to obtain sufficient hydrolysis made the quantity of iron too small to give any further evidence by the usual method of observation. However, the use of a sunlight spectrum showed an effect as soon as one began to pass from the transparent spectral region into the absorption region. The half-shade polariscope could be read to 0.01°, and in the red the difference between a .01 normal solution (hydrolysis forced by heating the solution) and water was not more than 0.01°. The difference between an unhydrolyzed solution of this concentration and water was also unobservable. Upon examination of the hydrolyzed solution at a point in the green where the absorption is very marked, a rotation of .79° was observed, while at the same point the other two solutions showed no difference. That is, we have here an anomalous rotary polarization or 'Faraday Effect,' analogous to anomalous dispersion. It is clear that in this case the anomaly arises from molecules in the region of their absorption. It remains to be seen whether such an anomaly will also arise in solution where the absorption arises from ions.

11. 'Discharge of Electricity from Glowing Platinum and the Velocity of the Ions': E. Rutherford.

A rectangular platinum plate 14 cm. long, 7.5 cm. wide and .002 cm. thick, was heated to incandescence by an electric

current. The platinum plate was charged to a known potential by means of a battery and the current between the platinum plate and a parallel copper plate observed by means of a sensitive galvanometer. The rate of discharge of positive and negative electrification was examined under varying conditions of temperature, distance and P. D. between the plates, and compared with the theoretical results deduced from the ionization theory of gases.

At a temperature of a dull red heat positive ions are produced at surface of the platinum plate, which travel to the opposite plate through the gas, if the platinum is positively charged. The movement of the ions disturbs potential gradient between plates and at high temperatures the slope of potential near hot plate is extremely small.

Let i = current per sq. cm. through the gas.
n = number of ions per cc. at any point distant x from platinum plate.
V = P. D. between the plates.
K = velocity of positive ion for unit potential gradient.
e = charge on ion.
d = distance between the plates.

Assuming the potential gradient zero at the platinum surface, it can readily be shown that

$$i = \frac{9V^2K}{32\pi d^3}$$

The current is thus independent of number of ions produced, *i. e.*, the temperature of the plate, providing it exceeds a certain value. Experimentally it was found:

1. For a distance of 2 cm. and under, the current at first increased rapidly with rise of temperature up to a certain point, and then more slowly. For distances of from 3 to 8 cm. the current rose to a maximum, and then steadily decreased with rise of temperature.

2. The maximum current varied approximately as square of the P. D.

3. Current diminished more rapidly than $\frac{1}{d^3}$.

The differences observed in (1) and (3) between experiment and theory are due to (*a*) decrease of velocity of ions with distance from heated platinum plate, (*b*) presence of some very slow-moving carriers produced at platinum surface at high temperatures.

The velocity of the ions was measured by a direct method depending on the use of an alternating P. D. of known frequency. The method was similar to that used previously for determination of velocity of ions produced by ultra-violet light (*Proc. Roy. Soc.*, 1898). It was found that the velocity of ions was not a constant, but varied between wide limits.

This is probably due to difference in size of ions in consequence of their varying power of forming clusters of molecules round them.

The following table gives results obtained for different distances between plates. Under heading 'calculated velocity' are given values of K calculated from equation (1) by measuring maximum current i for given distance and voltage.

Distance between plates.	Velocity in cm. per sec. for 1 volt per cm.		
	Maximum.	Average.	Calculated.
2 cms.	13	7.8	5.5
3 "	7.9	5.8	3.2
5 "	—	4.7	2.2

12. 'On Conditions controlling the Drop of Potential at the Electrodes in Vacuum-Tube Discharge': CLARENCE A. SKINNER, University of Nebraska.

With the passage of electricity through rarefied gases, it requires, relatively, a very high P. D. to force the discharge directly across the space between the electrodes when these are brought within a certain small distance apart. To locate at what part of the path the potential increases was the primary object of this investigation.

The results led to a more general investigation of the drop of potential at the electrodes.

A cylindrical vacuum-tube, with disk electrodes (perpendicular to its axis) insulated so as to force the discharge directly across the space between them, and nitrogen were used. The potential of the gas at any position was obtained by a movable wire.

As the electrodes approach each other the drop at the anode remains constant so long as there is an extended positive column. With the anode passing through the Faraday dark space its 'drop' rises to a maximum and then falls to zero in the negative glow, but rises again *rapidly* as the anode moves into and through the cathode dark space. The cathode drop remaining constant until the anode reaches the cathode dark space begins then to increase with great rapidity. During these changes the conductivity of the gas does not vary.

These results are explained on the hypothesis that the impact velocity of the discharging ion tends to prevent charge from being transmitted to the electrode; that to give up its charge the ion must first come to rest.

Other Observations.—At the cathode the drop may be expressed by the equation

$$V = C + \frac{c}{p}(a + i) \quad .$$

where i is the current density; p, the gas pressure; C, a constant approximating in value the cathode drop, as measured by Warburg; c, a constant depending on the nature of the gas, but independent of the metal used as cathode; and a, a constant. At the anode the drop appears to vary according to a similar law, where c is about one thirty-fifth its magnitude at the cathode.

The great difference in magnitude of the drops at the two electrodes may be explained on the hypothesis that the positive ion is of much greater mass than the negative and hence (for the same impact velocity), its elastic reaction being greater, the greater resistance to its discharge.

The difference in the drop occasioned by the use of different metals may be explained by their contact-potentials. Of two metals, that possessing the greater attraction for negative electricity is found to possess the lower drop as anode, apparently by its attraction for the charge on the ion aiding in overcoming the elastic reaction of the impinging ion. The same applies to the cathode. (To be printed in the *Phil. Mag.*)

13. 'The Influence of Temperature upon the Photo-electric Effect': John Zeleny, University of Minnesota.

Ultra-violet light impinging upon negatively electrified bodies dissipates their charge. The electricity is supposed to be carried away by ions which are formed at the surface of the body by the rapid absorption of certain of the waves of the incident light. A study of the influence of temperature upon the effect was made to see if it would throw any light upon the question as to the relative parts played in the phenomenon by the material of the body and by the occluded gases. The charged body which was experimented upon was a platinum wire that could be heated by sending an electric current through it. The light used was obtained from an electric spark produced between two zinc rods by an induction coil. The results obtained are somewhat complicated. As the temperature was gradually increased to about 200° C., it was found that the rate at which the negative electricity was discharged diminished, but for still higher temperatures it increased again, so that at about 700° C., it was nearly three times its value at room temperature. The rate of discharge at certain temperatures depends considerably upon the immediate previous history of the wire, being much larger for a given temper-

ature, although diminishing with time, if the wire has just been hotter than if it has just been colder. The conditions at the surface of the body at these temperatures reach their steady state but slowly, while for temperatures below 100° C. this is acquired much more rapidly. Changes in the molecular arrangement of the body, as well as the amount oft he occluded gas, may play a large part in the phenomenon. From an iron wire the rate of discharge while small at the lower temperatures became many times larger at the higher temperatures. It was also found that a positively charged body does not lose any charge due to the action of the light, even when its temperature is raised to that of red heat. To get an explanation for the unipolarity of the photo-electric effect, we need but consider that the intra-molecular impulses which are produced by the light, and which give rise to the discharge, are able to throw off from the body the negative ions or corpuscles, but are not able to disengage the much larger positive ions for which the forces of restitution are correspondingly greater.

14. 'The Diminution of the Potential Difference between the Electrodes of a Vacuum Tube produced by a Magnetic Field': JOHN E. ALMY.

15. 'Note on the Discharge Current from a Surface of Large Curvature': JOHN E. ALMY, University of Nebraska.

The discharge from a wire to a surrounding concentric cylinder, with reference to discharge current, especially, is studied. The law of discharge, under the conditions given below is found, $I = aV(V-b)L/R^3$, where

I = the discharge current, passing from wire to cylinder.

V = the potential difference between wire and cylinder.

L = the length of the wire.

R = the radius of the cylinder.

b = a constant, with given apparatus and gas pressure, and is very approximately the 'minimum potential' of Röntgen.

a = a constant.

The applicability to the discharge was shown with gas pressures, from 20 to 75 cm. of mercury, with cylinders, up to 10 cm. in diameter. The proportionality of current to wire length holds so long as the wire length is greater than the radius of the cylinder used. Finally, the proportionality of current to the inverse cube of the cylinder radius does not hold accurately. More strictly speaking it may be said that $I \propto \frac{1}{R^n}$ and $3.3 > n > 2.8$, in the experiments made.

16. 'The Radiant Efficiency of Vacuum Tubes': E. E. ROBERTS.

17. 'On the Spark Discharge during Rapid Oscillations': K. E. GUTHE. (By title.)

18. 'Results of Recent Magnetic Work of the U. S. Coast and Geodetic Survey': L. A. BAUER. (By title.)

19. 'The Physical Decomposition of the Earth's Permanent Magnetic Field': L. A. BAUER. (By title.)

20. 'On the Calorimetric Properties of the Ferro-magnetic Substances, with special reference to Nickel-steel': B. V. HILL.

It is well known that the ferro-magnetic substances when heated through a certain range of temperature, depending on the nature of the substance, absorb latent heat and pass into an allotropic modification in which they are non-magnetic. Certain alloys (*e. g.*, nickel-steel) having been transformed into this state by heating, maintain it down to comparatively low temperatures, so that there are many so-called irreversible nickel-steel alloys to be obtained in both modifications within the same range of temperature (20° to 300° C.). This allows the properties of the alloys in the two states to be compared.

The latent heat of transformation for one sample of nickel-steel was found to be 2.783; that of another, 13.45; which, according to the theory of solutions, should have been 15.9—the application of the theory being, however, questionable. The specific heat of nickel-steel is greater in the non-magnetic state than in the magnetic (from 2 to 6 per cent., depending on the temperature interval through which it is obtained).

Six samples of iron differing in permeability showed that the greater the permeability of iron the smaller its specific heat. This supports the view that the difference in permeability is caused by a difference in composition of magnetic and non-magnetic iron.

21. 'On the Demagnetizing Effect of a Discharge in Iron when Electromagnetically Compensated': Zeno Crook.

22. 'The Absorption Spectra of Solutions of Potassium Permanganate': B. E. Moore, University of Nebraska.

The absorption spectra of solutions of the following concentrations, $.25n$, $.025n$, $.0025n$, $.00025n$ and. $000025n$ (n = normal), were studied.

The observations, though they may need later some slight correction, show that upon dilution the solutions become relatively darker in the blue, *i. e.*, there is a displacement of the absorption band toward the blue upon dilution. The phenomenon is explained upon the theory of dissociation.

23. 'The Absorption and Dispersion of Fuchsin': W. B. Cartmel. (By title.)

24. 'On the Determination of Dispersion by Means of Channeled Spectra with the Concave Grating': P. J. Antes.

25. 'Accidental Double Refraction in Liquids': Bruce V. Hill, University of Nebraska.

In a former paper upon this subject (*Phil. Mag.* (5), 48, p. 485) the writer gave results of a series of experiments upon gelatinizing solutions which became double refracting when subjected to a strain between rotating cylinders. The results indicated that we have in such solutions quasi-solids, and that there is a difference between colloid and crystalloid solutions not to be explained upon the assumption of a large molecular weight in the former.

The present experiments consist of an examination of water solutions of gelatine when subjected to a *static* strain. They vary in concentration from .1 per cent. to .5 per cent. and were too dilute to sustain their own weight. They were accordingly placed in thin-walled brass tubes 42.55 cm. in length and 2.77 cm. in diameter. Glass caps were fastened to the ends of these tubes by slipping short pieces of rubber hose over them. The tubes were strained, so that their cross-sections were elliptical, by means of clamps. The double refraction decreases so rapidly with rise in temperature that at room temperature—about 23° C.—no effect was visible in jellies of the above concentrations. The tubes were then surrounded by ice and the formation of dew upon the glass ends was obviated by slipping over the tube a second one, also having a glass cap and containing a little phosphoric anhydride. The amount of double refraction was measured as before by means of a half-shade polariscope. The seven sets of observations show that when a stress is applied, the strain increases to a certain point beyond which no further strain is produced. Further stress ruptures the solution, and the refraction diminishes or ceases. The amount a solution can be strained without rupturing depends upon the age of the solution. This point was sufficiently studied to show that the diluter jellies required much longer time to reach the point where they would sustain a maximum strain than the stronger jellies. Along with double refraction, depolarization also appears and then diminishes after standing some time.

These solutions are as fluid as water, but still behave optically as quasi-solids, capable of sustaining a static strain without a displacement of the mobile particles. This condition is reached very slowly and the depolarization early in the formation indicates that the progress of formation of the solid structure is not homogeneous, but that it later becomes so, as indicated by the disappearance of the depolarization.

26. 'Notes on Dielectric Strain': LOUIS TRENCHARD MORE, University of Cincinnati.

This paper—'Notes on Dielectric Strain'—is an answer to a paper by Dr. Paul Sacerdote (*Philosophical Magazine*, March, 1901), criticizing an article by me which appeared in the *Philosophical Magazine* for August, 1900. In attempting to extend the work of Quincke and others who found that glass, when electrified, elongated proportionally to the square of the difference of potential and inversely as the square of the thickness of the dielectric, I noticed that after errors were eliminated the effect vanished or was at least less than $\frac{\delta l}{l} = 10^{-13}$—a result much less than that found by former investigators. My work attracted the attention of Professor Cantone and Dr. Sacerdote, the latter of whom had recently published a theoretical discussion of the subject. This theory is based on a coefficient which expresses the relation between the potential and the elongation and so fails if the elongation is eliminated. Dr. Sacerdote's criticism showed, I thought, that he had not understood my results and had underestimated the delicacy of my apparatus which seems fully capable of recording the changes of length noticed by the most accurate of former investigators—Professor Cantone.

I have in these papers shown that my apparatus was capable of measuring the effect—that it did record an effect similar to that noted by other investigators, but that this effect was due to bending of the glass tube by electrostatic attraction—that this error being eliminated the effect vanished.

The sources of errors of former investigators are probably the following:

1. No adequate precautions were taken against lateral bending of the tube. The changes of length produced by an extremely small deflection would account for the entire amount of the effect.

2. The elongations are too close to limit of observation to establish a law when the effect itself is still questionable.

3. Changes of length on charge and discharge are not equal. This difference sometimes equals 40 per cent. of the entire change. An extraneous effect of such magnitude casts doubt on the cause of the elongation.

4. With each investigator, using improved and more delicate apparatus, the amount of the effect steadily decreases. This points either to a partial or entire influence of extraneous causes. (To be printed in the *Philosophical Magazine.*)

27. 'The Temperature Gradient of the Atmosphere, with Formula': S. R. COOK, Washburn College.

The author calls attention to the difficulty, in discussing the escape of gases from the atmosphere, of determining the temperature of the station in the upper atmosphere under consideration.

From the kite observations of the United States Weather Bureau and the recent balloon ascensions at Paris, it was shown that the rate of decrease of temperature with altitude was not constant.

From balloon ascensions made March 24, 1899, near Paris, an experimental formula $t_z = t_0 e^{-kx}$ was obtained for the temperature gradient when t_z and t_0 are the absolute temperatures at positions whose distances from the surface are x, and at the surface respectively, and when k is a constant obtained from the balloon ascensions.

The graph of the temperature gradient is given and compared with Ferrel's graph. A density graph computed from the pressure and temperature graphs is also given and compared with Cottier's density graph computed from the formula $\frac{p_0}{p_1} = \left(\frac{\rho_0}{\rho_1}\right)^v$ where v has the experimental value 1.2.

Attention is also called to the need of more accurate and systematic data for the determination of the temperature gradient at altitudes from 5,000 to 20,000 meters.

John Zeleny,
Secretary.

THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.

SECTION G, BOTANY.

The Section met for organization on Monday, August 26, at 11.30 a. m., with the Vice-President, Mr. B. T. Galloway, in the chair. The following were the officers for the Denver meeting:

Vice-President, B. T. Galloway.

Secretary, E. A. Bessey (in absence of A. S. Hitchcock).

Sectional Committee, Wm. Trelease, Vice-President 1900; D. T. MacDougal, Secretary 1900; B. T. Galloway, Vice-President 1901; E. A. Bessey, Secretary 1901; C. E. Bessey, C. L. Shear, Miss C. E. Cummings.

Member of General Committee, W. J. Beal.

Member of Council, D. H. Campbell and L. M. Underwood.*

On Wednesday, August 28, in accordance with the custom established at the last New York meeting, Section G held a joint session with the Botanical Society of America, the officers of the latter taking charge of the meeting.

On Thursday evening the following were chosen by the General Committee as Vice-President and Secretary, respectively, for the Pittsburg meeting, June, 1902: D. H. Campbell, Leland Stanford University, and Hermann von Schrenk, Shaw School of Botany.

*Chosen to succeed D. H. Campbell after the latter's early departure.

The following is a complete list of the papers presented. Abstracts are given where furnished by the authors, except for the papers presented at the joint meeting with the Botanical Society of America, abstracts of which will be published elsewhere by the Secretary of that Society.

1. 'Thermal Relations of Plants': D. T. MacDougal. (No abstract furnished.)

2. 'Experiments with Lime and Solutions of Formaldehyde in the Prevention of Onion Smut': A. D. Selby.

Onion Smut, *Urocystis cepulæ* Frost, a soil-infesting fungus, has become introduced into soils devoted to the growing of onion sets near Chillicothe, Ohio, and into those devoted to the growing of market onions about Berea, Ohio. Certain results of experiments made in 1900 at Chillicothe were published in a bulletin (No. 122) of the Ohio Experiment Station. These showed decided advantages of quicklime applied to the soil before seeding and of dilute solutions of formaldehyde in water sprinkled upon the seeds in contact with the soil, as compared with flowers of sulphur, sulphur and lime (in small quantities), and other substances heretofore proposed for the prevention of onion smut. More extended experiments along these lines were conducted both at Chillicothe and Berea during 1901. The results from Chillicothe are now at hand and show very gratifying smut prevention and corresponding increase in the yield of onion sets. All plots herein considered are 760 square feet in area; results are stated in actual and calculated yields.

Plot.	Treatment.	Actual yield, lbs. per plot.	Calculated yield per acre, bushels.
I.	Lime, 34 bu. per A.	121.6	174.
II.	" 70 " " "	152.0	217.5
III.	Formalin, .375% sol.	196.0	280.8
IV.	Nothing	92. (large sets)	131.8
V.	Formalin, .75% sol.	202.	289.4
VI.	Lime, 125 bu. per A.	203.	290.8
VII.	" 70 " " " and Formalin, .375% sol.	214.	306.5

Thus lime, at the rate of 70 bushels per acre, gave an increase in yield of 65 per cent. over the untreated plot. Formalin, .375 per cent. solution, an increase of 113 per cent. and double that strength an increase of 119.6 per cent. Seventy bushels of lime per acre and the weaker solution of formalin combined gave an increase of 132.5 per cent., while lime at the rate of 125 bushels per acre gave an increase of 120.5 per cent. The lime used was purchased in the ground state and was applied with a drill before the hoes, chiefly on the surface. The formaldehyde solutions were applied by trickling down with the seeds. This paper will be printed in a bulletin of the Ohio Agricultural Experiment Station.

3. 'Comparative Climate of a Meadow and Hemlock Forest': D. T. MACDOUGAL. (No abstract furnished.)

4. 'The Tylostomaceæ of North America': V. S. WHITE, presented by L. M. Underwood.

The extensive accumulation of material bearing on the stalked puffballs in the Ellis collection, supplemented by considerable material sent in from the Southwest by Professors Wooton, Cockerell and Griffiths has led to a complete revision of the species of this family, which is now appearing in the August number of the *Bulletin of the Torrey Botanical Club*. This is illustrated by ten plates (exhibited when the paper was read). A summary of the results is as follows:

The family as represented in North America consists of—

Tylostoma—Seventeen species, of which eight are new. Of these seventeen species eight are found in Colorado, which is double the number from any other State with the single exception of Kansas, which has five species. Of the eight new species four are from Colorado.

Chlamydopus—One species recently collected in New Mexico by Professor Cockerell. The genus has hitherto been known only from South America.

Battarrea—Four species of which two are new. All from the Southwest.

Queletia—One species, possibly introduced from Europe. Found once in this country.

Dictyocephalos—A new genus from Colorado, collected by Professor Bethel, of Denver; monotypic.

Much still remains to be known of the early stages of these plants; in fact very little is known of them. Much also remains to be known of their geographic and seasonal distribution. Two-thirds of the family belong to the region of the Great Plains southwestward to Texas, Sonora and southern California.

5. 'Lantern Views of the Botanical Garden of the Agricultural College of Michigan': W. J. BEAL.

The author exhibited views showing the arrangement of the garden and gave many practical hints concerning the management of botanical gardens.

6. 'Plants of the Eastern Foothills': FRANCIS RAMALEY.

The author exhibited a number of views showing some of the more characteristic plants of the eastern foothills of the Rocky Mountains in Colorado.

7. 'Some Protective Leaf Movements induced by Winter Temperature': WM. TRELEASE.

The paper records, with lantern illustrations, observations upon the drooping and inrolling of *Rhododendron* leaves and the inrolling of leaves of *Yucca flaccida*, effected when the freezing temperature is reached, by which protection is secured against undue radiation and evaporation. Reference is made to Harshberger's paper of 1889, and Darwin and Acton's and MacDougal's text-books of plant physiology which thus far appear to refer only to *Prunus laurocerasus* and the genera named.

8. 'Germination of Seeds of some Common Cultivated Plants after prolonged Immersion in Liquid Air': A. D. Selby.

At the suggestion of Mr. J. E. Woodland, of Wooster, Ohio, who was conducting experiments with liquid air during the winter season of 1900–1901, the writer prepared and supplied him with seeds of *Ricinus*, *Lupinus luteus*, maize, flax, wheat, rye, cucumber, Russian sunflower, *Pinus sylvestris*, *Mimosa pudica*, *Onobrychis sativus*, *Chenopodium album* and *Pinus parryana*. At first the lots of seed were immersed in the liquid air directly from the room temperature and kept submerged for six and twelve hours, respectively. Later other lots were given a gradual transition from the temperature of the room to that of the liquid air and an equally gradual withdrawal, being immersed for twenty-four and forty-eight hours, respectively. The seeds were then germinated in the usual manner, together with control lots reserved when the original packages were selected. There was practically no essential effect of the treatment noticeable upon the percentages of seeds that germinated, the control, short treated, and longer treated lots giving essentially the same percentages of germination. This paper will be printed in the *Bulletin of the Torrey Botanical Club*.

On Wednesday the following program was given in joint session of Section G and the Botanical Society of America:

Address of the Retiring President—'Problems and Possibilities of Systematic Botany': B. L. Robinson. Read by J. M. Coulter.

'The Fundamental Phenomena of Vegetation': F. E. Clements.

'Early Winter Colors of Plant Formations upon the Great Plains': C. E. Bessey.

'The Plant Formations of the Rocky Mountains' (lantern lecture): F. E. Clements.

'A Suggested Hybrid Origin of *Yucca gloriosa*' (lantern lecture): Wm. Trelease.

'The Physical Basis of Ecology': F. E. Clements. (By title only.)

'The Anatomy of the Embryo and Seedling of *Tsuga canadensis* Carr' (by invitation): W. A. Murrill. Read by J. M. Coulter.

'Clues to Relationship among Heteræcious Plant Rusts': J. C. Arthur. Read by L. M. Underwood.

'Some of the Changes now taking place in a Forest of Oak Openings': W. J. Beal.

'Preliminary Notes on the Flora of Western Iowa, especially from the Physiographical-Ecological Standpoint': L. H. Pammel. (By title only.)

'The Life History of *Vittaria lineata*': E. G. Britton and A. Taylor. Read by L. M. Underwood.

'A System of Nomenclature for Phytogeography': F. E. Clements.

'The Application of Ecology in Taxonomy': F. E. Clements. (By title only.)

On Thursday the regular session of Section G was resumed with the following papers:

9. 'The Location of a Tropical Research Station in Porto Rico': L. M. Underwood.

The agricultural station in Porto Rico should, if possible, be located where it will also be available as a station for general botanical research. A combination of (1) the greatest amount of agricultural production, not alone in coffee, sugar and tobacco, but also in the minor products; (2) the greatest accessibility from all portions of the island, and particularly those portions where the most important agricultural products are cultivated under most favorable conditions; and (3) the most interesting botanical portion of the island, including accessibility to a large original forest, is met with in the eastern half of the island and particularly in the region between Arecibo and Utnado. With this can be com-

bined many less prominent but important accessories, particularly access to an abundant supply of potable water.

10. 'Notes on Colors of Salsify Hybrids': BYRON D. HALSTEAD.

Hybrids between *Tragopogon porrifolius* L. (garden salsify) and the wild species, *T. pratensis* L., were reported on last year. The following paper considers only the color side of the results obtained with hybrid seedlings the present year (second generation hybrids). According to the standard color chart employed (Prang's), the cultivated salsify has for the color of its corollas a mixture of violet and red, corresponding to No. 224 (VRV/L), *i. e.*, light violet red violet—a shade of purple, in ordinary language. The other parent has a plain yellow. The direct hybrid of these two is of two distinct types, the one with the color uniform throughout the head, and the other, about equally numerous, with a yellow in the center, although here the tips of all the corollas are of the same color as the ray blossoms, namely No. 241 (RRV/DD), *i. e.*, darker red red violet. It is seen by this that the *T. porrifolius* controls the color, although the violet of this parent gives place largely to red. The crossing is reciprocal and the results are the same whichever is the seed parent. Among the hundreds of seedlings grown this season no less than 36 numbers upon the color chart are represented. Out of 200 counts the following is the record for the 13 having the largest score: Yellow, 10; light yellow, 12; lighter yellow, 6; darker orange red orange, 9; darker red orange, 6; darker red, 23; dark red, 13; light red violet, 9; lighter red violet, 7; violet red violet, 23; light violet red violet, 35; lighter violet red violet, 29; dark violet gray, 6. It is seen that in the second generation the colors are many. Both parents are now represented, and many intergrades between their respective colors. The yellows in all the tints score 28 points to 103 by the violet reds. If all the shades obtained were enumerated under their appropriate heads the violet reds would outnumber the yellows by 41. There were no pure orange blossoms, but in combination with red there were many representatives. The yellow failed to blend with any other color. In one instance there was a plant with slate-colored blossoms, thus bringing in the blue of the chromatic scale, and several specimens had a strong tendency towards chlorosis, thus completing the series in the solar spectrum. A chart of the prismatic colors, violet, blue, green, orange, yellow and red was constructed, and the parent hybrid and its seedlings located with pasters of colored paper, while the relative amount of each of the latter was shown by the size of the paper bearing the color corresponding to that of the seedling hybrid flowers thus graphically represented. It is thus evident that with the salsify hybrid, while there is uniformity the first year, it is otherwise the second season, with a tendency to revert to the parent types. The red, present in obscure form in one parent only, becomes very prominent the first year and yields many unmixed reds the second. Out of this union by selection it is probable that many strongly contrasting types might be fixed.

11. 'Observations on *Egregia menziesii*': FRANCIS RAMALEY.

Egregia consists, as do the other Laminariaceæ, of hold-fast, stipe and lamina; the branching of the stipe gives rise to members (branches) each having the characters of the entire frond of *Alaria*. The multiform proliferations which occur on both stipe and lamina replace functionally the large lamina in other genera. This structure is, in *Egregia*, greatly reduced in size and importance. On account of the great elongation of the stipe a floating ap-

paratus has become necessary, and this is provided in the vesicles developed by the swelling of the stalks of certain proliferations. The presence of vesicles gives *Egregia* a superficial resemblance to *Macrocystis*, while it is probably more nearly allied to *Alaria*. A mathematical study of variation in *Egregia menziesii* leads to the conclusion that the species is in a state of equilibrium. The curves of variation are all symmetrical and remarkably similar. *Egregia* presents some interesting anatomical features which cannot be well summarized. This paper will be printed in *Minnesota Botanical Studies*.

12. 'The Morphology of the Pine Cone': C. E. Bessey.

Although there has been much discussion of the morphology of the 'ovuliferous scale' of the pine cone, recent summaries show that it is not yet satisfactorily settled. The author suggests an explanation which he has used in his lectures to students in the University of Nebraska for several years. Comparing the cones of Cupressineæ, Taxodieæ, Araucarieæ and Abietineæ, they are found to be alike, with a similar origin for their ovules, but in the Abietineæ there is in connection with each ovule a woody scale, while in Araucarieæ there is a rudimentary scale. This scale is regarded as a backward development of the ovule, and the cones are therefore strictly homologous. Concisely stated, this view may be formulated as follows: The microsporangial and megasporangial cones are strictly homologous, and in the latter the sporophyll enlarges or remains small, just as a chalazal development of the megasporangium into a scale is less or more pronounced. According to this view the Abietineæ must be given place at the summit of the Conifers. This paper will be printed in Science.

13. 'General Botanical Features of the Coast Mountains of California': Alice Eastwood.

The Coast Mountains of California extend from the northern to the southern part of the State, passing through about ten degrees of latitude, and rise from the sea level to an altitude of more than 9,000 feet. Consisting of many different chains and spurs, with valleys between made up of different geological formations, a great variety characterizes their flora. Many genera are in an unsettled condition and the species are uncertain. The outer ranges may be divided into four environmental zones: (1) That along the sea coast, characterized by fleshy plants or those clothed with some form of pubescence. They do not differ much from maritime plants in other regions. (2) The forest areas, along streams where the redwoods (*Sequoia sempervirens*) find a home. This keeps quite close within the area of summer fog, and the plants are dependent upon moisture and shade. (3) The grassy uplands and valleys. Here, during the rainy season, flowers (mostly annuals) grow in great profusion and form beautiful gardens. They soon disappear and the hills become yellow, except where clumps of oaks, pines, or spruces occur. (4) The brush-covered hills, where the shrubs grow so close together that it is almost impossible to travel through them except on the trails. They hold the water by their roots and prevent evaporation by their dense growth. Most of them show characteristics belonging to desert plants rendered necessary by the long drought and the intense heat to which they are subjected in the summer. The southern coast mountains become even more desert-like in the character of their flora, and here and there will be found wanderers from the desert. The northern coast mountains in general rise to a greater elevation, and in some of the chains the character of the mountains is like that of the Sierra Nevada range and the flora similar at like elevations. A great amount of work has to be

done before many of the genera are understood and a great deal of territory must be explored before the species are approximately known. Following this work, the problems of geographical distribution can be solved and life zones satisfactorily mapped out.

14. 'The Xerophytic Vegetation of the Uintah Mountains': L. H. PAMMEL.

In the Uintah range occur types of plants from the arid regions of the Southwest, boreal types in the mountains farther northward, and many forms from the main Rocky Mountain flora. The largest xerophytic areas occur in the Colorado and Green River basins. The xerophytic vegetation of the Uintah range varies with the different physiographic conditions and geologic formations. One naturally expects to find a very different flora in passing through the Green River and lower basins up to the higher peaks such as Gilbert, La Motte and Wilson; however, at an altitude of 9,200 feet the valleys and park-like openings have many xerophytic plants common to the lower basins of the streams. The succession of plant formation in this region is fairly well marked; it is not difficult, therefore, to trace a succession of plant life on the flood plains since the quaternary. The foothill and mountain floras change successively from hydrophytic to mesophytic, then to xerophytic and finally culminate in the mesophytic of the foothills with hydrophytic basins. In the Green River basin and the tributaries of the immediate vicinity of this basin the xerophytic plants are much more pronounced than in the foothills. In the broad flood plains of Green River there occur such plants as *Distichlis spicata*, the widely distributed *Hordeum jubatum*, and the western *H. cæspitosum*. The habit of growth and the manner of reproduction of *Distichlis* make it well adapted to the conditions prevailing in that arid region. Two Capparidaceous plants, *Cleome integrifolia* and *C. lutea*, are common. A somewhat similar yellow-flowered crucifer, *Stanleya pinnatifida*, is scattered through the dry lowlands. Naturally one expects to find many chenopodiaceous plants. Their succulent leaves enable them to adapt themselves to these dry regions. *Sarcobatus vermiculatus*, *Chenopodium fremontii*, *C. rubrum*, *Eurotia lanata* and *Suæda depressa* are common plants of the dry basins. *Artemisia tridentata* with its accompanying *Eriogonum ovalifolium* and *E. umbellatum* are common at higher altitudes along Black's Fork. The terrace formation is especially well marked from the mouth of Black's Fork up to 8,500 feet. In the lower region there are small groves of *Juniperus occidentalis* var. *monosperma*, frequently accompanied by *Picea pungens*, *Juniperus communis* and *Arctostaphylos*. At an altitude of 7,500 feet three well-defined flood plains are recognizable. The present flood plain contains mesophytic groves, the second flood plain is dotted with small patches of trees and sage brush, the third flood plain contains no trees. *Artemisia tridentata* is the most characteristic plant. *Symphoricarpos*, *Lupinus* and *Stipa* also occur. From the third flood plain there is an abrupt rise of from three to five hundred feet. The sides are lined with *Symphoricarpos*, *Prunus*, and some sage brush. The top of the benches contains almost no trees except farther up, but sage brush, *Eurotia lanata*, *Stipa*, *Castilleia*, *Orthocarpus* and *Eriogonum* are characteristic plants.

15. 'Some Aspects of the Wyoming Desert Flora': AVEN NELSON.

South central Wyoming contains an extensive area known as the Red Desert. This has a considerable flora, the most obvious members of which belong in the genera *Artemisia*, *Atriplex*, *Chrysothamnus*, *Tetradymia*, *Sarcobatus*, and *Agropyron*. Besides this there is a very considerable fugacious vegetation. This desert flora,

while a limited one, is highly organized. It is succulent and rich in water by reason of its many contrivances for husbanding all its resources. Consolidation tends to reduce expenditure. Pleiocyclic herbs successfully maintain themselves by reason of their highly developed underground organs. The prevailing color of the flowers is yellow. Some of the vegetation is exceedingly tolerant of alkali, raising the question whether this property is due to histological peculiarities or represents a physiological difference in the protoplasm.

16. 'Effects of Salt Solutions on Seeds and Plants': E. E. Slosson.

Experiments have been carried on for several years on the action of the salts occurring in the soil of arid regions, as alkali, on the germination of seeds and the growth of plants. Solutions of sodium chloride, sulphate and carbonate; potassium sulphate and chloride; magnesium sulphate; and sugar; in solutions ranging in strength from 0 to 100 atmospheres osmotic pressure had been tested, the following seeds being used: corn, wheat, sunflower, peas, buckwheat, rape, beans, alfalfa, rye, clover, *Scirpus paludosus* and, for comparison, wood. It has been found that the imbibition of water is less from all solutions than from pure water. Solutions of all salts and of sugar of the same osmotic pressure retard and lessen the imbibition of water by seeds to about the same extent. Isosmotic solutions produce nearly the same effect in retarding the germination of seeds. Solutions of slight osmotic pressure stimulate germination. The same results are obtained with growing plants. Plants and seeds absorb a greater amount of potassium than of sodium salts from solutions of the same osmotic pressure, and more sulphates than chlorides. Hydroxyl ions increase the absorption of salts and of water by seeds. This paper will be printed in Bulletins of the Wyoming Experiment Station.

17. 'The Position of Protococcus and Mosses on Trees': Henry Kraemer. (Read by title.)

18. 'Contributions to the Knowledge of the Physiology of Karyokinesis': A. C. Lewis. (Read by title.)

This paper will be published in the *Botanical Gazette*.

19. 'Seedlings of *Arisæma dracontium*': Rosina J. Rennert. (Read by title.)

20. 'Some Plant Adaptations on the Tucson Plains': J. W. Toumey. (Read by title.)

Ernst A. Bessey,
Secretary, Section G.

MEMBERSHIP OF THE AMERICAN ASSOCIATION.

The following have completed their membership in the American Association for the Advancement of Science during the month of September.

Edward G. Acheson, President International Acheson Graphite Co., Niagara Falls, N. Y.

Curtis Alexander, Mining Engineer and Metallurgist, Spearfish, S. D.

J. Hartley Anderson, M.D., Physician, 4630 Fifth avenue, Pittsburg, Pa.

Bion J. Arnold, 4128 Prairie avenue, Chicago, Ill.

Andrew J. Bigney, Professor of Biology and Geology, Moores Hill College, Moores Hill, Ind.

R. I. Bond, M.D., Physician, Hartshorne, Ind. Ter.

Edwin D. Carnaghan, Mechanical Engineer, Durango, Do, Mexico.

Willard Colfax Cheney, Electrical Engineer, Portland, Ore.

Francis A. Crandall, 2219 15th street, N.W., Washington, D. C.

Col. William Crozier, U. S. A. Ordnance Office, Washington, D. C.

Dr. Kary Cadmus Davis, Professor of Horticulture and Forestry, W. Virginia State University, 628 N. High street, Morgantown, W. Va.

Wm. S. Hall, Professor of Mining and Graphics, Lafayette College, Easton, Pa.

John Hays Hammond, Mining Engineer and Geologist, Denver, Colorado.

Dr. Felix B. Herzog, Electrical Engineer, 51 West 24th street, New York, N. Y.

Julius Hortvet, State Chemist, 1521 University avenue S.E., Minneapolis, Min-

A. E. Jenks, Bureau of Ethnology, Washington, D. C.

John A. Just, Chemist, 116 West Castle street, Syracuse, N. Y.

Wm. D. Marks, The Art Club, Philadelphia, Pa.

Lucius Herbert Merrill, Professor of Biological Chemistry, University of Maine, Orono, Maine.

Benjamin L. Miller, Johns Hopkins University, Baltimore, Md.

Robert D. Murray, M.D., Marine Hospital Service, Key West, Fla.

George J. Murdock, Mechanician and Inventor, 248 Sixth avenue, Newark, N. J.

Richard A. Parker, C.E., E.M., 4 P. O. Square, Boston, Mass.

Thomas S. Perry, 312 Marlborough street, Back Bay, Boston, Mass.

Wm. L. Prather, President of University of Texas, 1914 Nueces street, Austin, Texas.

Walter Merritt Riggs, Professor of Electrical Engineering, Clemson College, Clemson College, S. C.

Fred W. Robins, Superintendent of Schools, Bethlehem, Pa.

George St. John Sheffield, Twin Elms Farm, Attleborough, Mass.

Charles H. Shinn, Inspector of Experiment Stations, University of California, Berkeley, Cal.

Harvey F. Smith, Attorney-at-law, Clarksburg, W. Va.

Norman W. Storer, Electrical Engineer, 6109 Howe Street, Pittsburg, Pa.

W. S. Sutton, Professor of Science and Art of Education, University of Texas, 1812 Congress avenue, Austin, Texas.

E. A. H. Tays, Civil and Mining Engineer, San Jose de Gracia, Sinaloa, Mexico.

Alonzo P. Troth, Supervisor of Instruction in Science, High School, Leadville, Colo.

Andrew A. Veblen, Head of Department of Physics, State University of Iowa, Iowa City, Iowa.

Wm. A. Wadsworth, Genesee, Livingston county, N. Y.

Dr. Walter F. Willcox, Professor of Economics, Cornell University, Ithaca, N. Y.

---

*ADDRESS OF THE PRESIDENT OF THE ANTHROPOLOGICAL SECTION OF THE BRITISH ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.**

I.

TWENTY-FIVE years have passed since the British Association met in Glasgow. This is a long time to look back upon, and yet the period appears short when measured by the great advance which has taken place in almost all branches of knowledge. Anthropology has shared in the general progress. The discoveries made within its confines may not have been so startling, nor yet have had such a direct influence upon the material welfare of the people, as in the case of other fields of scientific study, but its development has been steady and continuous, and it has grown much in public estimation.

At the Glasgow meeting of the Association in 1876 anthropology held a subsidiary position. It only ranked as a department, although it gained a special prominence through having Alfred Russel Wallace as its chairman. It was not until several years later that it became one of the recognized sections of the Association, and attained the high dignity of having a letter of the alphabet allotted to it. But quite independently of its official status it has always been a branch of study which has been accorded a large amount of popular favor. The anthropological meetings have, as a rule, been well attended, and the discussions, although perhaps on certain occasions somewhat discursive, have never lacked vigor or animation. Professor Huxley, who presided over the Anthropological Department at the Dublin meeting in 1878, ascribed the popularity of the subject to the many openings which it affords for wide differences of opinion between the exponents of its numerous branches, and to the innate bellicose tendency of man. As the representative of a country in which, according to the same high authority, this tendency is less strongly marked than elsewhere, and of a race which has so frequently and pointedly exhibited its abhorrence of vigorous language, I trust that my presence here as president may not react unfavorably on the interest shown in the work of the Section.

* Glasgow meeting, 1901.

The present occasion might appear to be peculiarly appropriate for my taking stock of our anthropological possessions and summing up the numerous additions to our knowledge of 'man and his doings' which have been made during the century which has just passed. Such a task, however, is surrounded with so much difficulty that I shrink from undertaking it. The scope of the subject is enormous, and the studies involved so diverse and so varied that I feel that it is beyond my power to give any comprehensive survey of its development in all its parts. I prefer therefore to confine my remarks to that province of anthropology within which my own work has been chiefly carried on, and from this to select a subject which has for some years held a prominent place in my thoughts. I refer to the human brain and the part which it has played in the evolution of man.

One of the most striking peculiarities of man, when regarded from the structural point of view, is the relatively great size of his brain. Although with one or two exceptions the several parts of the brain are all more or less involved in this special development, it is the cerebral hemispheres which exhibit the preponderance in the highest degree. This characteristic of the human brain is rendered all the more significant when we consider that the cerebral hemispheres cannot be looked upon as being primitive parts of the brain. In its earliest condition the brain is composed of three simple primary vesicles, and the cerebral hemispheres appear in a secondary manner in the shape of a pair of lateral offshoots or buds which grow out from the foremost of these primitive brain-vesicles.

The offshoots which form the cerebral hemispheres are found in all vertebrates. Insignificant in size and insignificant in functional value in the more lowly forms, a steady increase in their proportions is manifest as we ascend the scale, until the imposing dimensions, the complex structure, and the marvelous functional potentialities of the human cerebral hemispheres are attained. In their development the cerebral hemispheres of man rapidly outstrip all the other parts of the brain, until they ultimately usurp to themselves by far the greater part of the cranial cavity. To the predominant growth of the cerebral hemisphere is due the lofty cranial vault of the human skull; to the different degrees of development and to the different forms which they assume are largely due the variations in cranial outline in different individuals and different races—variations in the determination of which the craniologist has labored so assiduously and patiently.

I think that it must be manifest to every one that the work of the craniologist, if it is to attain its full degree of usefulness, must be founded upon a proper recognition of the relation which exists between the cranium and the brain, or, in other words, between the envelope and its contents.

The cranium expands according to the demands made upon it by the growing brain. The initiative lies with the brain, and in normal conditions it is questionable if the envelope exercises more than a very subsidiary and limited influence upon the form assumed by the contents. The directions of growth are clearly defined by the sutural lines by which the cranial bones are knit together; but these are so arranged that they admit of the expansion of the cranial box in length, in breadth and in height, and the freedom of growth in each of these different directions has in all probability been originally determined by the requirements of the several parts of the brain.

The base or floor of the cranium, supporting as it does the brain-stem or the parts which possess the greatest phylogenetic antiquity, and which have not under-

gone so large a degree of modification in human evolution, presents a greater uniformity of type and a greater constancy of form in different individuals and different races than the cranial vault, which covers the more highly specialized and more variable cerebral hemispheres.

To what extent and in what directions modifications in the form of the cranium may be the outcome of restrictions placed on the growth of the brain it is difficult to say. But, broadly speaking, I think we may conclude that the influence which the cranium, under normal circumstances, independently exerts in determining the various head-forms is trifling.

When we speak, therefore, of brachycephalic or short heads and dolichocephalic or long heads, we are merely using terms to indicate conditions which result from individual or racial peculiarities of cerebral growth.

The brachycephalic brain is not molded into form by the brachycephalic skull; the shape of both is the result of the same hereditary influence, and in their growth they exhibit the most perfect harmony with each other.

Craniology has been called the 'spoiled child of anthropology.' It is supposed that it has absorbed more attention than it deserves, and has been cultivated with more than its share of care, while other fields of anthropology capable of yielding rich harvests have been allowed to remain fallow. This criticism conveys a very partial truth. The cranium, as we have seen, is the outward expression of the contained brain, and the brain is the most characteristic organ of man; cranial peculiarities, therefore, must always and should always claim a leading place in the mind of the anthropologist; and this is all the more imperative, seeing that the brains of different races are seldom available for investigation, whilst skulls in the different museums may literally be counted by thousands.

Meantime, however, the craniologist lies buried beneath a mighty mountain of figures, many of which have little morphological value and possess no true importance in distinguishing the finer differences of racial forms. Let us take as an example the figures upon which the cephalic or length-breadth index of the skull is based. The measurement of the long diameter of the cranium does not give the true length of the cranial cavity. It includes, in addition, the diameter of an air-chamber of very variable dimensions which is placed in front. The measurement combines in itself, therefore, two factors of very different import, and the result is thereby vitiated to a greater or less extent in different skulls. A recent memoir by Schwalbe * affords instructive reading on this matter. One case in point may be given. Measured in the usual way, the Neanderthal skull is placed in the dolichocephalic class; whereas Schwalbe has shown that if the brain-case alone be considered it is found to be on the verge of brachycephaly. Huxley, many years ago, remarked that 'until it shall become an opprobrium to an ethnological collection to possess a single skull which is not bisected longitudinally,' in order that the true proportions of its different parts may be properly determined, we shall have no 'safe basis for that ethnological craniology which aspires to give the anatomical characters of the crania of the different races of mankind.' It appears to me that the truth of this observation can hardly be disputed, and yet this method of investigation has been adopted by very few craniologists.

It has become too much the habit to measure and compare crania as if they were separate and distinct entities and without a due consideration of the evolutionary

* 'Studien über Pithecanthropus erectus' (Dubois). *Zeitschrift f. Morph. und Anthrop.*, Band I., Heft 1, 1899.

changes through which both the brain and its bony envelope have passed. Up to the present little or no effort has been made to contrast those parts of the cranial wall or cavity which have been specially modified by the cerebral growth-changes which are peculiar to man. It may be assumed that these changes have not taken place to an equal extent, or indeed followed identically the same lines in all races.

Unfortunately our present knowledge of cerebral growth and the value to be attached to its various manifestations is not so complete as to enable us to follow out to the full extent investigations planned on these lines. But the areas of cerebral cortex to which man owes his intellectual superiority are now roughly mapped out, and the time has come when the effect produced upon the cranial form by the marked extension of these areas in the human brain should be noted and the skulls of different races contrasted from this point of view.

To some this may seem a return to the old doctrine of phrenology, and to a certain extent it is; but it would be a phrenology based upon an entirely new foundation and elaborated out of entirely new material.

It is to certain of the growth changes in the cerebrum which I believe to be specially characteristic of man, and which unquestionably have had some influence in determining head-forms, that I wish particularly to refer in this address.

The surface of the human cerebrum is thrown into a series of tortuous folds or convolutions separated by slits or fissures, and both combine to give it an appearance of great complexity. These convolutions were long considered to present no definite arrangement, but to be thrown together in the same meaningless disorder as is exhibited in a dish of macaroni. During the latter half, or rather more, of the century which has just ended it has, however, been shown by the many eminent men who have given their attention to this subject that the pattern which is assumed by the convolutions, while showing many subsidiary differences, not only in different races and different individuals, but also in the two hemispheres of the same person, is yet arranged on a consistent and uniform plan in every human brain, and that any decided deviation from this plan results in an imperfect carrying out of the cerebral function. In unraveling the intricacies of the human convolutionary pattern it was very early found that the simple cerebral surface of the ape's brain in many cases afforded the key to the solution of the problem. More recently the close study of the manner in which the convolutions assume shape during their growth and development has yielded evidence of a still more valuable kind. We now know that the primate cerebrum is not only distinguished from that of all lower mammals by the possession of a distinct occipital lobe, but also by having imprinted on its surface a convolutionary design which in all but a few fundamental details is different from that of any other order of mammals.

There are few matters of more interest to those anthropologists who make a study of the human skull than the relationship which exists between the cranium and the brain during the period of active growth of both. Up to the time immediately prior to the pushing out of the occipital lobe, or, in other words, the period in cerebral development which is marked by the transition from the quadrupedal type to the primate type of cerebrum, the cranial wall fits like a tight glove on the surface of the enclosed cerebrum. At this stage there would appear to be a growth antagonism between the brain and the cranial envelope which surrounds it. The cranium, it would seem, refuses to expand with a speed sufficient to meet the demands made upon it for the accommodation of the growing brain. In

making this statement it is right to add that Hochstetter, in a carefully reasoned memoir, has recently cast doubt upon the reality of the appearances which have led to this conclusion, and at the recent meeting of the Anatomische Gesellschaft, in Bonn, Professor Gustaf Retzius,* one of the numerous observers responsible for the description of the early cerebrum upon which the conclusion is based, showed some inclination to waver in his allegiance to the old doctrine. This is not the time nor the place to enter upon a discussion of so technical a kind, but I may be allowed to say that whilst I fully recognize the necessity for further and more extensive investigation into this matter I do not think that Hochstetter has satisfactorily accounted for all the circumstances of the case.

When the occipital lobe assumes shape the relationship of the cranial wall to the enclosed cerebrum undergoes a complete change. The cranium expands so rapidly that very soon a wide interval is left between the surface of the cerebrum and the deep aspect of the cranial envelope within which it lies. This space is occupied by a soft, sodden, spongy meshwork, termed the subarachnoid tissue, and it is into the yielding and pliable bed thus prepared that the convolutions grow. At first the surface of the cerebral hemisphere is smooth, but soon particular areas of the cortex begin to bulge out and foreshadow the future convolutions. These suffer no growth restriction, and they assume the form of round or elongated elevations or eminences which rise above the general surface level of the cerebral hemisphere and break up its uniform contour lines in the same manner that mountain chains protrude from the surface of the globe.

As growth goes on, and as the brain gradually assumes a bulk more nearly in accord with the cavity of the cranium, the space for surface protrusions of this kind becomes more limited. The gyral elevations are now pressed together; they become flattened along their summits, and in course of time they acquire the ordinary convolutionary shapes. While this is going on the valleys or intervals between the primitive surface elevations become narrowed, and ultimately assume the linear slit-like form characteristic of the fissures. These changes occur shortly before birth, but are not fully completed until after the first few months of infancy. The final result of this process is that the convolutions come into intimate relation with the deep aspect of the cranial wall and stamp their imprint upon it.

It is obvious that certain of the later changes which I have endeavored to portray might be ascribed to a growth antagonism between the brain and the enclosing cranium at this period. In reality, however, it is merely a process by which the one is brought into closer adaptation to the other—a using up, as it were, of superfluous space and a closer packing together of the convolutions—after the period of active cortical growth is past. Nevertheless the convolutionary pattern is profoundly affected by it, and it seems likely that in this process we find the explanation of the different directions taken by the cerebral furrows in brachycephalic and dolichocephalic heads.

The cortical elevations which rise on the surface of the early cerebrum are due to exuberant growth in localized areas. There cannot be a doubt that the process is intimately connected with the development of function in the districts concerned. We know that functions of different kinds are localized in different parts of the cortex, and when we see an area on the surface of the early cerebrum rise up in the form of

* *Anatomische Gesellschaft*, Bonn, May 28, 1901. Gustaf Retzius, 'Transitorische Furchen des Grosshirns.'

an eminence, we may reasonably conclude that the growth in the area concerned is the structural foundation of what will become later on a center of functional activity of an acute kind.

A consideration of this matter gives the clue to the simple convolutions of the ape and the complex convolutions of man, and, further, it explains how the interrupted form of fissural development is one of the essential characteristics of the human brain as compared with the simian brain. Areas which rise up in the form of one long elevation on the surface of the ape's brain appear in the form of several eminences on the surface of the human brain, and fissures which appear in the form of long continuous slits in the simian cerebrum appear in the human cerebrum in several detached bits, which may or may not in the course of time run into each other and become confluent. All this is due to the greater definition, refinement and perfection of the functions carried on in the cerebral cortex of man. It is an index of a more complete 'physiological division of labor' in the human brain.

It is not necessary, for the purpose I have in view, to enter into any detail regarding the many points of difference which become evident when the cerebral surface of the ape is compared with that of man. It is more my purpose to indicate certain of the districts of cerebral cortex which have undergone a marked increase in the human brain—an increase which may be reasonably supposed to be associated with the high mental attributes of man. To us, at the present time, it is difficult to conceive how it was ever possible to doubt that the occipital lobe is a distinctive character of the simian brain as well as of the human brain, and yet at successive meetings of this Association (1860, 1861 and 1862) a discussion, which was probably one of the most heated in the whole course of its history, took place on this very point. One of our greatest authorities on animal structure maintained that the occipital lobe and the hippocampus minor—an elevation in its interior—were both peculiar to man and to him alone. Every one has read in the 'Water Babies' Charles Kingsley's delightful account of this discussion. Speaking of the Professor he says: "He held very strange theories about a good many things. He had even got up at the British Association and declared that apes had hippopotamus majors in their brains just as men have. What a shocking thing to say; for if it were so, what would become of the faith, hope and charity of immortal millions? You may think that there are other more important differences between you and an ape, such as being able to speak, and make machines, and know right from wrong, and say your prayers, and other little matters of that kind; but that is a child's fancy." In the light of our present knowledge we can fully understand Professor Huxley closing the discussion by stating that the question had 'become one of personal veracity.' Indeed, the occipital lobe, so far from being absent, is developed in the ape to a relatively greater extent than in man, and this constitutes one of the leading positive distinctive characters of the simian cerebrum. Measured along the mesial border, the percentage length of the occipital lobe to the total length of the cerebrum in the baboon, orang and man is as follows:

Baboon	29.7
Orang	23.2
Man	21.2

But these figures do not convey the full extent of the predominance of the occipital lobe in the ape. The anterior border of the lobe grows forwards beyond its proper limits, and pushes its way over the parietal lobe which lies in front, so as to cover over a portion of it by an overlapping lip termed

the occipital operculum. There is not a trace of such an arrangement in the human brain, and even in the anthropoid ape the operculum has become greatly reduced. Indeed, in man there is exactly the reverse condition. The great size of the parietal lobe is a leading human character, and it has partly gained its predominance by pushing backwards so as to encroach, to some extent, upon the territory which formerly belonged to the occipital lobe.* A great authority † on the cerebral surface refers to this as a struggle between the two lobes for surface extension of their respective domains. "In the lower apes," he says, "the occipital lobe proves the victor; it bulges over the parietal lobe as far as the first annectant gyrus. Already in the orang, the occipital operculum has suffered a great reduction; and in man the victory is on the side of the parietal lobe, which presses on the occipital lobe and begins, on its part, to overlap it." Now that so much information is available in regard to the localization of function in the cerebral cortex, and Flechsig has stimulated our curiosity in regard to his great 'association areas' in which the higher intellectual powers of man are believed to reside, it is interesting to speculate upon the causes which have led to the pushing back of the scientific frontier between the occipital and parietal cerebral districts.

The parietal lobe is divided into an upper and a lower part by a fissure, which takes an oblique course across it. Rudinger,‡ who studied the position and inclination of this fissure, came to the conclusion that it presents easily determined differences in accordance with sex, race and the intellectual capacity of the individual. He had the opportunity of studying the brains of quite a number of distinguished men, amongst whom were Bischoff of Bonn, Döllinger of Munich, Tiedemann of Heidelberg, and Liebig of Munich, and he asserts that the higher the mental endowment of an individual the greater is the relative extent of the upper part of the parietal lobe.

There is absolutely no foundation for this sweeping assertion. When the evolutionary development of the parietal part of the cerebral cortex is studied exactly the reverse condition becomes manifest. It is the lower part of the parietal lobe which in man, both in its early development and in its after-growth, exhibits the greatest relative increase. Additional interest is attached to this observation by the fact that recently several independent observers have fixed upon this region as one in which they believe that a marked exuberance of cortical growth may be noted in people of undoubted genius. Thus Retzius has stated that such was the case in the brains of the astronomer Hugo Gyldén,* and the mathematician Sophie Kovalevsky;† Hansemann‡ has described a similar condition in the brain of Helmholtz; and Guszman§ in the brain of Rudolph Lenz, the musician. Some force is likewise added to this view by Flechsig, who, in a recent paper,‖ has called atten-

* It is necessary to emphasize this point, because in Wiedersheim's 'Structure of Man' we are told that in man there is a preponderance of the occipital lobe, and that the parietal lobe is equally developed in man and anthropoids.

† Eberstaller, *Wiener Medizinische Blätter*, 1884, No. 19, p. 581.

‡ 'Beiträge zur Anatomie und Embryologie,' als Festgabe Jacob Henle, 1882.

* Retzius, *Biologische Untersuchungen*, neue Folge, VII., 1898, 'Das Gehirn des Astronomen Hugo Gyldéns.'

† Retzius, *Biologische Untersuchungen*, neue Folge, IX., 1900, 'Das Gehirn der Mathematikerin Sonja Kovalevsky.'

‡ Hansemann, *Zeitschrift für Psychologie und Physiologie der Sinnesorgane*, Band XX., Heft 1, 1899, 'Ueber das Gehirn von Hermann v. Helmholtz.'

§ Josef Guszman, *Anatomischer Anzeiger*, Band XIX., Nos. 9 and 10, April, 1901, 'Beiträge zur Morphologie der Gehirnoberfläche.'

‖ Flechsig, 'Neue Untersuchungen über die Markbildung in den menschlichen Grosshirnlappen,' *Neurologisches Centralblatt*, No. 21, 1898.

tion to the fact that within this district there are located two of his so-called 'Terminalgebiete,' or cortical areas, which attain their functional powers at a later period than those which lie around them, and which may therefore be supposed to have specially high work to perform.

Without in any way desiring to throw doubt upon the observations of these authorities, I think that at the present moment it would be rash to accept, without further evidence, conclusions which have been drawn from the examination of the few brains of eminent men that have been described. There cannot be a doubt that the region in question is one which has extended greatly in the human brain, but the association of high intellect with a special development of the region is a matter on which I must confess I am at present somewhat sceptical.

But it is not only in a backward direction that the parietal lobe in man has extended its territory. It has likewise increased in a downward direction. There are few points more striking than this in the evolution of the cerebral cortex of man. In order that I may be able to make clear the manner in which this increase has been brought about, it will be necessary for me to enter into some detail in connection with the development of a region of cerebral surface termed the *insular district*. The back part of the frontal lobe is also involved in this downward extension of surface area, and, such being the case, it may be as well to state that the boundary which has been fixed upon as giving the line of separation between the parietal and frontal districts is purely artificial and arbitrary. It is a demarcation which has no morphological significance, whilst from a physiological point of view it is distinctly misleading.

D. J. Cunningham.

[*To be concluded.*]

SCIENTIFIC BOOKS.

Die Partiellen Differential-Gleichungen der Mathematischen Physik. Nach Riemann's Vorlesungen. In vierter Auflage. Neu bearbeitet von Heinrich Weber, Professor der Mathematik an der Universität Strasburg. Braunschweig, Druck und Verlag von Friedrich Vieweg und Sohn. 1900, 1901. Erster Band, pp. xvi + 506; Zweiter Band, pp. xi + 527.

The appearance of this new and greatly enlarged edition of the work founded on Riemann's lectures will be welcomed with delight by every student of the mathematico-physical sciences. Those acquainted with the preceding capital edition of Hattendorff do not need to be reminded of the high model of excellence in exposition he set. Professor Weber has not only amplified this model, but he has fairly canonized it, placing before the student a glorified summary of the physical concepts and the mathematical methods on which the great progress of the nineteenth century in physical science rests.

It is a good sign of the times that many eminent European mathematicians are reverting to the example set by the illustrious Gauss and followed with such signal success by Riemann, Clebsch, Kirchhoff and others. The advantages to be gained by the pure and by the applied mathematician in following such an example are mutual so far as existing science is concerned, while the better understanding of one another's work which results therefrom makes it easier to secure that sort of cooperation essential to rapid and permanent advances. The mathematical physicist is, therefore, under deep obligations to Professor Weber for the admirable presentation he has given us of the more important and more difficult branches of mathematical physics.

The reader who may be unacquainted with the earlier editions of this work should be warned against supposing it to be a treatise on any one of the subjects considered. Its great merit lies in the fact that while not a treatise, it states the salient principles and essential mathematical features of many branches of physics with a clearness and with an attractiveness rarely attained in formal treatises. No previous work, so far as we are

aware, is quite so successful in producing for the student the right combination of physical and mathematical difficulties.

The first volume is divided into three principal parts and into twenty-three sections. The first part is devoted to pure analysis, with sections in order on definite integrals, Fourier's integral, infinite series, Fourier's series, multiple integrals, functions with complex arguments, differential equations, and Bessel's functions. The second part treats of geometrical and mechanical theorems, with sections on linear infinitesimal deformation, vectors, the potential function, examples of potential function, spherical harmonics, and the fundamental principles of mechanics. The third part is devoted to applications in the fields of electricity and magnetism, with sections on electrostatics, problems in electrostatics, magnetism, electrokinetics, electrolytic conduction, steady electrical currents, flow of electricity in surfaces, flow of electricity in space and electrolytic displacements.

The second volume is divided into five parts and into twenty-three sections. The first part is concerned with the theory of linear differential equations, with sections on integration by means of hypergeometric series, integration by means of definite integrals, the *P*-function of Riemann, and, under the heading Oscillationstheoreme, a section treating very fully the equation $d^2y/dx^2 + \rho y = 0$, where ρ is in general a function of x. The second part is devoted to heat diffusion, with sections on the differential equation of heat diffusion, the problem when dependent on a single coordinate, and the problem of diffusion in a sphere. The third part is devoted to the theory of elasticity, with sections on the general theory of elasticity, statical problems, equilibrium and deformation of an indefinite isotropic solid, vibrations of stretched cords, Riemann's method of integration, vibration of membranes and the general theory of the differential equation of a vibrating membrane. The fourth part is occupied with electrical oscillations, with sections on electric waves, linear electric currents, and reflection of electric oscillations. The fifth part treats of hydrodynamics, with sections on general theorems, motion of rigid bodies in fluids (two sections), discontinuous fluid motion, propagation of an impulse in a gas and aerial vibrations of finite magnitude.

When all parts of a work like this one are noteworthy for their unsurpassed excellence, it is difficult to cite parts specially commendable or to call attention to small defects. Every reader, according to his bias, will be drawn first to those sections in which he has special interest, and he must be a narrow specialist if he does not find many such sections. Generally, the work is to be praised for its admirable clearness. Some of us foreigners find the German frequently lacking in directness and perspicuity; and we are especially mystified often by the offensive use of italics so common with writers whose thoughts are unclarified. Professor Weber's style, however, is as transparent as that of the best French standards, and in this respect his work recalls the faultless exposition of such great masters as Gauss and Kirchhoff.

The typography of the work is likewise unsurpassed. It, like the selection of the subject-matter and the treatment thereof, is a model for all makers of mathematical books. Book makers and publishers in America should take note of the fact that each of the volumes of this work (comprising over 500 pages per volume) 'made in Germany,' is beautifully printed, on excellent paper, and is yet less than 30 millimeters thick over all, including the rather stout half-morocco binding. To do as well in our country it will be essential to discard the miserable, thick, talc-loaded or lead-loaded paper now so commonly used here.

It would be possible to find some small faults with the presentation and treatment of the topics, here and there. 'There are spots on every sun'; but in this case, as with our orb, they do not disturb the general luminosity, and we may expect to see them disappear from future editions. In the meantime, students of mathematics and physics generally will find this work a mine of instructive and inspiring information accessible by the aid of a full table of contents and a good index. Every worker in mathematical physics should have the volumes constantly within an arm's reach.

R. S. W.

A Text-book of Astronomy. By GEORGE C. COMSTOCK, Director of the Washburn Observatory and Professor of Astronomy in the University of Wisconsin. New York, D. Appleton and Company. Cloth. Pp. 391. Price, $1.30.

Written in simple, clear and concise language, illustrated by appropriate and well-constructed figures, made interesting by apt and homely comparisons and useful by numerous and well-chosen exercises, this book forms a welcome addition to the list of elementary text-books of astronomy. Professor Comstock has written a new book and has not merely rearranged the material of earlier ones. His purpose is clearly outlined in the first paragraph of the preface: "The present work is not a compendium of astronomy or an outline of popular reading in that science. It has been prepared as a text-book, and the author has purposely omitted from it much matter interesting as well as important to a complete view of the science, and has endeavored to concentrate attention upon those parts of the subject that possess special educational value. From this point of view, matter which permits of experimental treatment with simple apparatus is of peculiar value and is given a prominence in the text beyond its just due in a well-balanced exposition of the elements of astronomy, while topics, such as the results of spectrum analysis, which depend upon elaborate apparatus, are in the experimental part of the work accorded much less space than their intrinsic importance would justify."

Inspection of the table of contents shows that the author has departed widely from the conventional methods of treating the elements of the subject, especially in the first six and the eighth chapters. The special features of the book are numerous questions scattered throughout the text, to teach the student to think and construct as well as to read and assimilate; and many exercises, in the nature of laboratory work, all to be performed with simple apparatus, easily constructed by the students themselves. In these exercises the students obtain practice in the three fundamental processes of all practical astronomy, the measurement of time, angle and distance. Although the exercises are numerous, still the author has not exhausted the list and might with profit have given more.

It would have been well, if possible, to so arrange the material that the exercises, which all fall in the first five chapters, would be more distributed. It is not necessary, of course, that the teacher present the material in just the order given, but the facts are that the large majority of teachers will present it in that way. The author has, apparently, purposely avoided all reference to the *Nautical Almanac* and *American Ephemeris*. The wisdom of this is open to question. While it is unnecessary and certainly unwise to introduce the *Ephemeris* at first and thus make the student dependent upon it, still I think it equally unwise to totally exclude it. An explanation of the *Ephemeris* and a few exercises which demand its use should, I think, be included in the most elementary course in practical astronomy. Any school in which astronomy is taught can surely afford to buy one of these books each year, and any person capable of teaching the subject should be able to use the book intelligently.

Many bits of good advice are given in connection with the exercises. On page 3, for instance, in connection with a measurement to be made, we find: "But perfection can seldom be attained, and one of the first lessons to be learned in any science which deals with measurement is that however careful we may be in our work, some minute error will cling to it and our results can be only approximately true. This, however, should not be taken as an excuse for careless work, but rather as a stimulus to extra effort in order that the unavoidable errors may be made as small as possible."

A point to be commended is the use of the metric system throughout the exercises. In the descriptive parts of the text, however, the author retains the English units. Perhaps it is best to break away gradually, but I believe no criticism would have been offered if the metric system had been used throughout.

The illustrations and figures of the book are well chosen and the student should learn something from each. Very few, if any, have been inserted for pictorial effect. Among the figures

which deserve special mention are Nos. 16 and 17, from which the position of any of the five brighter planets may be determined for a number of years; No. 23, which ingeniously illustrates the tide-raising forces; No. 54, illustrating the moon's rotation; No. 121, illustrating the determination of parallax of the fixed stars.

Of the many apt illustrations contained in the book, the following, page 121, is one of the best: "Every such timepiece, whether it be of the nutmeg variety which sells for a dollar, or whether it be the standard clock of a great national observatory, is made up of the same essential parts which fall naturally into four classes, which we may compare with the departments of a well-ordered factory: I. A time-keeping department, the pendulum or balance spring, whose oscillations must all be of equal duration. II. A power department, the weights or main spring, which, when wound, store up the power applied from outside and give it out piecemeal as required to keep the first department running. III. A publication department, the dial and hands, which give out the time furnished by department I. IV. A transportation department, the wheels, which connect the other three and serve as a means of transmitting power and time from one to the other.

"The case of either clock or watch is merely the roof which shelters it, and forms no department of its industry. Of these departments the first is by far the most important, and its good or bad performance makes or mars the credit of the clock."

The last chapter, growth and decay, deserves special mention. It is a clear, philosophic treatment of the best theories of sidereal evolution, and although not out of place in a high-school text, it might well form a part of a larger treatise.

SIDNEY D. TOWNLEY.

UNIVERSITY OF CALIFORNIA,
May 1, 1901.

SCIENTIFIC JOURNALS AND ARTICLES.

THE *Journal of Physical Chemistry*, June, 1901. 'The Theory of Electrolytic Dissociation as viewed in the Light of Facts recently ascertained,' by Louis Kahlenberg; 'On the Generalization of Clapeyron's Equation,' by Paul Sorel; 'On the Phase Rule,' by Paul Sorel. This paper by Dr. Kahlenberg demands more than passing mention. Since its enunciation by Arrhenius in 1887, the theory of electrolytic dissociation has received a recognition which has rarely been accorded a scientific theory in so short a time, and few theories have been so productive of results. Unhesitating assent has been by no means accorded it by many, especially of the older, chemists, but few attempts have been made to reveal its weaknesses experimentally. Dr. Kahlenberg, himself a pupil of Ostwald, has been one of the few who have from time to time called attention to experimental facts which were not in accord with the theory. In his present paper, the author first details a large amount of experimental work on the electrical conductivity of solutions at low and at high temperatures, and on molecular weight determinations by boiling point and cryoscopic methods, in solutions of gradually increasing strength, in which is shown often a great discrepancy between the results and those required by the dissociation theory. He then proceeds to discuss at length these and many other failures of the theory, drawing the conclusion that the theory is applicable to a decidedly limited class of solutions. The true nature of solutions must be reached by a study, not of those extremely dilute, but first of the concentrated solution, approaching the dilute solution as a limiting case. In conclusion, he says: "It must be fully and freely admitted that the dissociation theory has done much good in stimulating research in many lines. It has been fruitful in proportion to the amount of truth contained in it. Like other theories founded upon too narrow a basis of induction, it has gradually been outgrown—the facts are too much for it. It would be difficult of course to say of any theory—even of one long ago discarded—that it is entirely worthless, and so the writer has no inclination to make such a statement concerning the dissociation theory. * * * It is solely because of the rapid growth of the erroneous idea that the deductions drawn from the indiscriminate application of the simple gas equation to solutions and from the notion that all well-known facts harmonize with the theory

of electrolytic dissociation, that I have felt compelled to call attention to the real status of the experimental facts underlying these deductions."

J. L. H.

The Popular Science Monthly for October has for its opening article 'The Progress of Science,' by R. S. Woodward, being the address of the retiring president of the American Association. George Stuart Fullerton discusses 'Free-will' and the 'Credit for Good Actions' and Alexander McAdie presents some 'Fog Studies on Mount Tamalpais,' hinting at the possibility of dissipating such fogs as the one in which the steamer *Rio de Janeiro* was lost. Hugh M. Smith describes 'The French Sardine Industry' pointing out incidentally improvements that might be made in that of the United States. 'The Late Epidemic of Smallpox in the United States' is considered by James Nevins Hyde who makes a strong plea for vaccination. Edward Atkinson treats of 'Food and Land Tenure,' considering that the free land tenure of the United States is at the bottom of our great agricultural development. The final article is by W. Ramsay on 'The Inert Constituents of the Atmosphere,' describing the methods by which some of these have been discovered. The number completes Vol. LIX. and the index is appended.

The American Naturalist for September contains the third instalment of W. M. Wheeler's important and interesting description of 'The Compound and Mixed Nests of American Ants,' which includes in the present part the slave-keeping ants. The bulk of the number is taken up with the seventeenth of the 'Synopses of North American Invertebrates,' in which H. S. Jennings treats of the Rotatoria, the paper being illustrated by nine plates comprising 171 figures.

The *Museums Journal* of Great Britain for September contains a brief account of the work of 'The International Zoological Congress,' which includes some notes on the museums of Berlin and Hamburg, a paper by H. M. Platnauer, 'To Utilize Specialists,' and an account of the 'Museum of Science and Art, Edinburgh,' a very popular institution if one may judge by the annual attendance of 350,000. A number of samples of labels used in the U. S. National Museum are given and there are notes concerning various museums and art galleries in different parts of the world.

SOCIETIES AND ACADEMIES.

NEW YORK ACADEMY OF SCIENCES, SECTION OF ASTRONOMY, PHYSICS AND CHEMISTRY.

The section met on October 7, at the Chemist's Club. Professor Wm. Hallock reported that he had tried and failed to obtain permission of the Calumet and Hecla Company to make measurements of underground temperatures in their shaft at Keweenaw Point during the summer. He described and exhibited before the Section a new and very simple form of wind musical instrument which he found on sale at the Buffalo Exposition. The instrument was operated by blowing through the nose, the mouth cavity of the operator acting as the resonance chamber of the instrument. The tone quality was very similar to that of a flute.

Professor J. K. Rees reported that the Astronomical Department of Columbia had received from the Lick observatory a number of star photographs which were to be measured for the determination of parallax. Professor Harold Jacoby reported upon some photographs of stars near the celestial poles which had been received by the department.

Professor R. S. Woodward reported the results of an investigation he had carried on upon the effects of secular cooling and meteoric dust on the length of the terrestrial day. His investigation showed that, due to secular cooling, the length of the day will not change or has not changed, as the case may be, by so much as a half second in the first ten million years after the initial epoch, and that the total effect from secular cooling will accrue before the effect from meteoric dust will begin to be appreciable.

Professor DeRemus gave a brief account of the research laboratory in chemistry which had been lately established at Schenectady, N. Y.

F. L. Tufts,
Secretary.

THE ELISHA MITCHELL SCIENTIFIC SOCIETY.

THE 136th meeting of the Society was held at the University of North Carolina, on Tuesday evening, October 8, when the following papers were presented:

'Interpretation of the Value $\frac{0}{0}$': PROFESSOR WILLIAM CAIN.

'The Work of the Beaufort Laboratory during the Season of 1901': PROFESSOR H. V. WILSON.

'Note on the Existence of a New Element associated with Thorium': PROFESSOR CHAS. BASKERVILLE.

The permanent secretary, President F. P. Venable, reported some four or five hundred exchanges as continued, and favorable progress in the cataloging and binding of the journals received in exchange.

The following officers were elected for the year: *President*, Dr. H. V. Wilson; *Vice-President*, Dr. A. S. Wheeler; *Secretary*, Dr. Chas. Baskerville.

CHARLES BASKERVILLE,
Secretary.

DISCUSSION AND CORRESPONDENCE.

AN INSTITUTE FOR BIBLIOGRAPHICAL RESEARCH.

TO THE EDITOR OF SCIENCE: In these days when large endowments are made for furthering scientific research in many directions, it is only natural that bibliographers and librarians should look forward eagerly to an endowment in the interest of that science which is the foundation of library work and, in a way, of all scientific investigation. Without bibliographies knowledge of what has been previously done in the various sciences would be wellnigh impossible; the investigator would be groping in the dark, and many a work would be written to demonstrate what had already been well demonstrated. Without bibliographies the building up of an ever so modest library would be beset with difficulties without end.

The thought that such an endowment must be made was in everybody's mind at the meeting this summer of the American Library Association. The plans for cataloging at one place books for all libraries in the country, which were discussed at the last two conferences of the Association (Montreal, 1900, and Waukesha, 1901), presuppose a central bureau of some kind to organize the work and carry it out. The generous way in which the Librarian of Congress met the Publishing Board of the Association gives assurance that the cataloguing of the current literature will be taken care of through the National Library. But this is only one part of the needed work. If thus the American literature of the new century will be permanently recorded (it is to be hoped that the work will be retrospective so as to cover the whole of the year 1901) we shall still lack an accurate bibliography of the American literature of past times.

There are other works of great importance that should be undertaken. Let me mention a few:

Bolton's catalogue of scientific and technical periodicals covers only one group of sciences and does not cover that one completely. A complete and accurate catalogue of serial publications of all kinds, including such as are published by societies, academies and other institutions, is a desideratum.

There is no critical and complete bibliography of bibliographies in existence. Petzholdt's monumental work does not go beyond 1866, and Henri Stein's recent volume, while bringing his predecessor's work fairly down to date, is anything but critical. It is doubtful whether a really authoritative catalogue of bibliographies can be produced without the cooperation of bibliographers and specialists in this country and Europe.

The catalogue of scientific literature undertaken under the auspices of the Royal Society of London has met with gratifying support from American libraries. But the 'Regional Bureau' for America that should do our part of the work is not yet founded. The Smithsonian Institution has provisionally undertaken to act as 'Regional Bureau,' but with all the other demands on it it is uncertain how long it can continue to cooperate in this work.

This catalogue is planned to cover only the natural and physical sciences. It is of the utmost importance that other sciences also should be covered by similar catalogues.

Furthermore, the Royal Society catalogue

covers only the current literature. The older publications should not be neglected, but should be cataloged in a series of monographs on special subjects.

The annotation of books by experts, advocated for many years with rare enthusiasm by Mr. George Iles, or at least the indexing and condensing of authoritative book reviews, is another work that would naturally come within the scope of a Central Cataloguing Bureau.

And finally, the bibliographical interests need an organ of their own where problems can be discussed and results made known.

It is clear that all these various undertakings, if carried out simultaneously, would result in a great deal of unnecessary duplication were there no central organization to guide and supervise the whole, and, if no provision were made for the utilization in many places of any title entry needed in several catalogues, without the necessity of setting up the matter anew for every time. As long ago as 1850, Professor Charles C. Jewett proposed that stereotype plates be made of the titles of all the books in American libraries, these to be kept at the Smithsonian Institution and to be utilized for the printing of catalogues of any library desiring it. The cost was too large then and the proposition too new. What was then looked upon as the visionary, though interesting, dream of an enthusiast, is now a reality, proved to be of economic value. The experience of the John Crerar Library with electrotype plates for title entries, used for printing of catalogues in book form as well as on cards, has been that the cost of making these plates and of their care and handling is less than that of printing the same matter over again from newly set type.

The purpose of these lines has been to call attention to the need of an Institute for Bibliographical Research where all the bibliographical and library interests of the country would center, and I hope that they may reach some one who might be able and willing to endow such an institute.

Aksel G. S. Josephson.
The John Crerar Library, Chicago,
Sept. 10, 1901.

DISCORD.

To the Editor of Science: Permit me to respond briefly to Mr. W. Le Conte Stevens's remarks on 'Discord and Psychology' in the issue of Science for September 20. (1) How Mr. Stevens found out that I had not read the investigations of Professor Mayer on this subject is an enigma to me. His intimation that they were unknown to me is based solely on the fact that I do not swear by the authority of these investigations, made 25 years ago (1875). I have known them for many years. But I know also many more recent investigations which do not agree with those of Mayer. Physicists who are interested in psychological theories and discuss them in their text-books may keep up with current literature by looking once a year at the 'Psychological Index,' published annually by the *Psychological Review*, or at any other psychological bibliography. (2) With Mr. Stevens's request to criticize from the psychological standpoint the sentences quoted by him, I shall gladly comply by quoting a few sentences from a physicist who was unusually familiar with psychological literature, namely the late Professor Melde, who says (Winkelmann's 'Handbuch der Physik,' I., p. 789): 'Eine Hauptstörung eines regelmässigen Tones oder eines consonirenden Zusammenklanges bilden die Stösse oder Schwebungen. Sie können durchs Zusammenwirken der primären Töne, also durch Interferenz entstehen, oder es können auch auf rein mechanische Weise solche Stösse erzeugt werden. Ihre Wirkung muss in beiden Fällen mehr oder weniger die einer Beimischung eines Rasselgeräusches sein. Zur Erklärung des inneren Wesens einer Con oder Dissonanz können aber nach des Verfassers Ueberzeugung auch nicht die Stösse (*viz.*, auch nicht Nebentöne) herangezogen werden, denn *eine sogenannte Dissonanz besteht sicherlich auch ohne jedes Verhandensein von Stössen.*" Let me further quote from Stumpf, 'Konsonanz und Dissonanz' (1898), p. 5, where the author discusses the very investigations of Professor Mayer which I am supposed to have ignored: "Wir können Intermissionen in *beliebiger Frequenz* auch bei zwei *konsonanten* Tönen künstlich herstellen, *ohne dass sie dissonant würden.*"

When there are beats, the psychologist speaks

of beats; when the beats are comparatively frequent, he speaks of 'roughness'; but the psychologist does not arbitrarily call roughness 'discord.' Upon the *cause* of discord the psychologists have *not* agreed; it is as yet unknown —at least to the psychologists.

MAX MEYER.
UNIVERSITY OF MISSOURI.

A CORRECTION.

IN SCIENCE for September 27, 1901, I called attention to a signature of a work entitled 'Florula Lexingtoniensis,' which I then supposed to be a work of C. S. Rafinesque. There is now no doubt that the signature in question is part of a work with the same title which appeared in the *Transylvania Journal of Medicine*, under the authorship of C. W. Short. The signature had been repaged, and does not have the appearance of a journal extract.

WILLIAM J. FOX.
ACADEMY OF NATURAL SCIENCES
OF PHILADELPHIA, PA.

CURRENT NOTES ON PHYSIOGRAPHY.

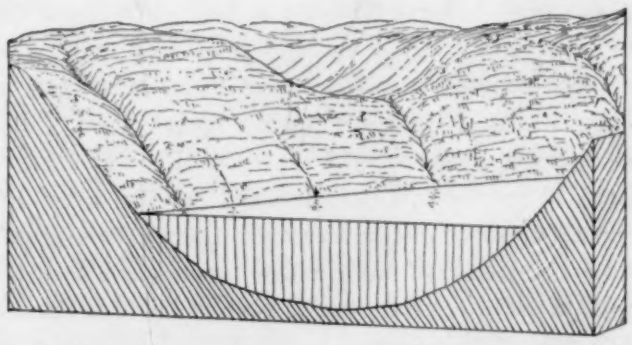
MT. KTAADN.

Two visits to Mt. Ktaadn (5,150′) in northern Maine and four ascents have convinced Tarr that even the summit of the mountain has been glaciated, for fragments of schist, argillite and sandstone were found on its granite peaks ('Glaciation of Mt. Ktaadn, Maine,' *Bull. Geol. Soc. Amer.*, XI., 1900, pp. 433–448, 10 pl.). The greater part of the top is occupied by a 'tableland' surmounted by the several summits and gnawed into by huge basin headed valleys or corries, whose smooth and precipitous walls can hardly be scaled. Little talus lies in the basins, but a number of rock-basin lakes and terminal moraines were found on the valley floors. Where the basins come close together they are separated by sharp ridges, whose ruggedness Tarr accounts for by the moderate destructive action of the upper part of the ice sheet, as well as by postglacial weathering. He suggests that large local glaciers radiated from Ktaadn after the time of general glaciation.

Following the views of Richter, de Martonne and Matthes, recently noted in these columns, and the still earlier views of Johnson, the steep walls and sharp dividing ridges between the Ktaadn corries would be ascribed to the retrogressive erosion of their local glaciers, aided by the excessive frost action of the Bergschrund belt; and the 'tableland' would be regarded as a residual of a larger preglacial dome.

NORWEGIAN FIORDS.

THE year-book of the Norwegian geological survey for 1900 ('Norges geologiske Undersögelse,' No. 32, Aarbog for 1900, Kristiania, 1901, p. 263, many sketches and an English summary), contains an account of two important landslips in postglacial clays and a general discussion of the relief of certain typical areas. The highlands are regarded as presenting traces of two cycles of erosion; the older appears in the lofty snow-covered plateaus, more or less mountainous; the younger in the broad, open, high-level valleys among the high plateaus. The deeper valleys, whose deepest distal portions contain the fiords, are of later origin, after a great upheaval of the land, and are probably the work of water and ice in several interglacial and glacial epochs. Regarding the relative proportions of ice and water work, Reusch appeals to certain fiorded valleys, in whose walls a number of ravines have been produced by ordinary subaerial erosion. In such cases, the valleys must have been, Reusch thinks, worn nearly to their present depth before the ravines could have been formed. Hence "the glaciers enlarged the main valley and partly destroyed the side valleys, but they cannot be said to have made the main valley." But this conclusion leaves the problem in a quandary; for if the ravines indicate the preglacial depth of the main valley, it is difficult to understand why certain



hanging lateral valleys, whose streams are much larger than those in the ravines, were not also

worn down in preglacial time to the great depth of the main valley. Moreover, as a rule, the fiord walls are not strongly ravined; they are generally rather smooth, as if they had been severely scoured. May it not therefore be supposed that the ravines are of late interglacial origin in rock structures that favor relatively rapid wearing; and that they have been eroded with respect to a valley floor which earlier glacial erosion had already deepened; while a minimum measure of the total glacial erosion is best given by the altitude of the large hanging valleys above the fiord bottoms, huge as the minimum may be?

THE ORIGIN OF MOELS.

'The Origin of Moels, and their Subsequent Dissection' (*Geogr. Journ.*, XVII., 1901, 63–69) is a discussion by Marr of the rounded mountains common in several parts of Great Britain, showing convex, dome-like tops and concave basal slopes, all covered with rock waste and vegetation, and not dissected by streams. Etymologically they are the Welsh equivalents of the 'balds' of our North Carolina mountains. Their form is ascribed to weathering under vegetation. The irregular forms into which a tableland is carved by streams would in time be subdued to moels, if weathering under a climate which favored the growth of a mantle of vegetation by which streams are excluded. In an arid or frigid climate, sharp peaks or ridges with even-sloping sides would, it is said, be developed, while running water would carve the well-known concave valley lines with steepening slope to their sources. The author goes on to show that if streams should gain a hold on a moel, either by climatic change destroying the plant mantle or by headward growth from the basal slopes, radial valleys would be carved by retrogressive erosion. Such valleys would in time reduce the intervening spurs into sharp ridges; notches would be worn in the narrowing ridges near the summit, where they are soonest consumed by the widening valley heads; and the peak of each ridge, just outside of the notch, would then be a 'tahoma,' as Russell has called such forms on Mt. Rainier (18th Ann. Rep. U. S. G. S., pt. II., 349). When one side of a mountain is exposed to rainy winds, while the other side is relatively dry, the convex moel slope may be paired with the concave stream slope, as in certain parts of the English lake district.

Soil-creeping might have been given more explicit consideration than it here receives; for both the convex upper summit and the concave basal slopes of a valleyless moel may be largely produced by the slow creeping of the waste cover, as well as or better than 'partly by the action of the wind, and partly by inconstant runnels of water.' It seems unadvisable to treat moels as exhibiting 'the ultimate outlines of mountains which have been shaped by denudation'; for the ultimate outlines are level to the eye, and even the penultimate outlines have but a faint relief as the moels fade away. It is questionable whether the attainment of a convex summit outline is impossible in arid and frigid deserts; more probably it is merely delayed till the reduction of the mountain to a moderate relief in a late stage of the cycle weakens the forces of waste transportation to essential equality with forces of waste supply; a graded waste cover may then be formed all over the surface, whose outline will exhibit no sharp forms, but only gentle undulations. These undulations may be too gentle to be classed with the strong moels of Wales, but they deserve consideration in the general study of land forms.

W. M. Davis.

THE PHYLOGENY OF THE TOOTHED WHALES.

A recent issue of the *Memoirs of the Royal Museum of Natural History of Belgium* is devoted to a paper by Dr. O. Abel on the 'Longirostrine Dolphins of Bolderien,' in which the author describes and figures in detail the skulls of two remarkable extinct dolphins, *Cyrtodelphis sulcatus* and *Eurhinodelphis cocheteuxi*. The memoir is, however, a great deal more than the description of these crania, valuable though this be, for nearly one-half of it is devoted to observations on the phylogeny of the Odontoceti. We have a discussion of the evidence furnished by the dentition in general, and that of the pre-maxillaries in particular, the dermal armor and the general characters of

the cranium. Following this is a diagram showing *Zeuglodon* at the bottom and *Ziphius* as the most highly modified genus at the top, other genera, recent and fossil, being indicated in their proper positions at either side. This portion of the work is replete with information and abounds in references to other papers. There are, however, two points to which it may be well to call attention: The first of these is the assumption that *Zeuglodon is* the ancestor of the toothed whales, the other is the assumption that *Zeuglodon* had a highly developed dermal armor, amounting in fact to a carapace. Both of these conclusions should for the present be held in abeyance, as neither is as yet proven. This may perhaps be modified somewhat by saying that under the term *Zeuglodon* are included two perfectly distinct genera, *Basilosaurus* and *Dorudon*, and that while it seems very improbable that the former left any descendants, the structure of the latter is much nearer that of modern whales and these may be descended from that genus. There is, however, a large undescribed cetacean, indicated by vertebræ in the U. S. National Museum, found in the Eocene of Alabama and a knowledge of this form may throw some light on the problem of the origin of modern toothed whales. As to the defensive armor of *Zeuglodon* it may be well to discuss this at length later; for the present it may be said that the fine material collected by Mr. Schuchert for the U. S. National Museum shows nothing more than a few dermal ossicles, about the size of one's fist, of a rounded shape and slightly keeled on one edge. Had there been any extensive dermal armor it seems likely that it would have been collected, or at least seen, by Mr. Schuchert.

F. A. L.

ANTHROPOLOGY AT THE UNIVERSITY OF CALIFORNIA.

A DEPARTMENT of anthropology has, as we have already noted, been established by the regents of the University of California. The work of this department, for the present, will be anthropological research and the formation of a museum. Mrs. Phoebe A. Hearst has for several years been collecting a large amount of valuable material from the several expeditions she has established, particularly in Egypt, in Peru and in California. These collections she gives to the University at Berkeley. The University has also a large collection from Alaska, presented by the Alaskan Commercial Company; and it is known that other collections are to become the property of the University when the museum is established. There are also now in the University many archeological specimens and human crania obtained from various parts of the state. For the storage and preservation of all this valuable material a temporary fire-proof building of brick and iron is to be erected at once. It is believed that this action will also be an incentive to the friends of the University to provide the funds for a museum building adequate for the proper exhibition of the collections in all departments.

As an encouragement to others and as an expression of her great interest in the new department, Mrs. Hearst, who is one of the regents and a most generous patron of the University, makes a gift of $50,000 a year for five years for anthropological research. This amount will be devoted to continuation of the work in Egypt and in South America and to securing Greek and Roman antiquities; also to a thorough research of the archeology and ethnology of California, with particular reference to investigations of the deposits from the supposed Pliocene gravels to recent times, with the object of discovering when man first appeared on the Pacific Coast; also to a study of the many Indian tribes of California, their languages, myths and customs. For this work several parties are already in the field.

At present there will be no regular courses in the department, but university lectures on special topics in anthropology will be given from time to time. The first of these lectures was delivered on September 20 by Professor F. W. Putnam, who was invited to outline the purpose and scope of the new department and the methods of anthropological research. This was followed by a lecture on the study of the Indians by Miss Alice C. Fletcher; and the third lecture is to be by Mrs. Zelia Nuttall on the picture-writing of the ancient Mexicans.

Dr. A. L. Kroeber and Mr. P. E. Goddard have been appointed respectively instructor

and assistant in anthropology with assignment for field work among the Indians of California. Professor J. C. Merriam of the paleontological department has been given immediate charge of the research. Dr. P. M. Jones is engaged in archeological work with special reference to Santa Rosa Island. An honorary advisory committee has been appointed by the regents, as follows:

Dr. Benjamin I. Wheeler, President of the University.
Professor F. W. Putnam, Chairman of the Committee.
Mrs. Phoebe Hearst.
Miss Alice C. Fletcher.
Mrs. Zelia Nuttall.
Dr. Franz Boas.
Professor John C. Merriam.

Mr. J. G. M. E. d'Aquin has been appointed assistant secretary and executive officer of the department.

SCIENTIFIC NOTES AND NEWS.

THE eightieth birthday of Professor Rudolf Virchow has been celebrated in Berlin with elaborate ceremonies. The birthday actually occurred on Sunday, October 13, but the public exercises were on the previous day. There was a reception in the Pathological Institute in the afternoon and a banquet in the dining hall of the Prussian Diet in the evening, followed by an official reception in the parliament hall. Professor Waldeyer, secretary of the Berlin Academy of Sciences, presented 50,000 Marks, subscribed by medical men in Germany toward increasing the Virchow research fund. The Emperor has conferred an order and a medal, which have presumably been so long withheld owing to Professor Virchow's active participation on behalf of liberal institutions. The municipality of Berlin has resolved to call its new hospital, containing beds for 1,700 patients, the Virchowkrankenhaus. In New York City there was a banquet in honor of Virchow on October 12, when addresses were made by Drs. William Osler, W. H. Welch, A. Jacobi and A. H. Smith. Two days previously the Geselligwissenschaftliche Verein also celebrated the event, on which occasion addresses were made by Drs. A. Jacobi, Franz Boas and J. N. Senner.

A STATUE of Pasteur was unveiled on September 9, at Arbois, where he spent his childhood and his holidays in later life. The monument, erected at a cost of over $10,000, was designed by M. Daillon and represents Pasteur seated. On the pedestal are two bas-reliefs, one representing inoculation against rabies and the other agriculture profiting from Pasteur's discoveries. On the occasion of the unveiling addresses were made by M. Decrais, French minister of the colonies, and M. Liard, representing the Department of Public Instruction.

AMONG the scientific men who will be present as delegates at the bicentennial celebration of Yale University are: President H. S. Pritchett and Professors Wm. T. Sedgwick and George F. Swain from the Massachusetts Institute of Technology; President Schurman from Cornell University; Professors J. M. Van Vleck, W. N. Rice and W. O. Atwater from Wesleyan University, and Dr. H. C. Bumpus from the American Museum of Natural History.

DR. RUDOLF VON LEUTHOLD, has been appointed Staff-Surgeon-General of the German Army, in succession to the late Dr. von Coler.

SURGEON GENERAL GEORGE M. STERNBERG has returned to Washington after a tour of inspection in the Philippines.

PROFESSOR BASHFORD DEAN has returned to Columbia, after spending his sabbatical year in the east. He has brought back an almost complete series of developmental stages of the Port Jackson Shark, *Heterodontus japonicus*, a number of stages in the development of *Chlamydoselachus*, two new *Myxinoids*, a new *Chimæra*, together with a general zoological collection. During a visit to the Hokkaido (Yezo), he brought together several hundred specimens of Aino antiquities, which are now deposited in the American Museum of Natural History in New York. He also secured a collection of interesting glass sponges from the region of Misaki, which are also destined for the American Museum. Among other specimens are included a

number illustrating artificial selection; a series of the highly specialized varieties of Japanese gold fishes together with a number of the long-tailed fowls of Tosa, whose tail feathers sometimes reach the extraordinary length of fifteen feet. For the Columbia collection, he obtained during a visit in southern Negros, P. I., a series of dissections of *Nautilus*, prepared from fresh material. Dr. Dean, while in Japan, was the guest of the Imperial University of Tokyo, and spent most of his time at the zoological laboratory at Misaki.

PROFESSOR F. W. PUTNAM has recently returned from his trip through New Mexico and California. During part of the time he was engaged, in company with Professor J. C. Merriam, of the University of California, in a geological and archeological study of the gravels and other recent formations of California. For this purpose several caves in Calaveras and Tuolumne counties were explored, and human and other bones were found. Many old mining shafts and tunnels were also examined. On his way east Professor Putnam accepted an invitation to address the committee of the St. Louis World's Fair of 1903 in relation to the proposed ethnographical exhibit of the native peoples of the world.

MR. J. E. SPURR, who, as we have already noted, has been employed for geological surveys by the Sultan of Turkey, has begun his work in Macedonia and Albania.

DR. C. H. HERTY, of the University of Georgia, has during the summer been engaged in an investigation of the turpentine industry in southern Georgia. His results will appear in the bulletin of the Bureau of Forestry, for which he has acted as scientific assistant.

MR. WILLIAM L. CHERRY has returned to Chicago from a trip of several years' duration in Central Africa. He has brought with him to America a large ethnological collection.

DR. ROLAND B. DIXON has returned to Harvard University from an extended trip in Russia. Mr. W. C. Farabee, a graduate student at Harvard University, has been engaged during the summer in exploring a pueblo ruin in New Mexico, and A. M. Tozzer, a second-year graduate, has made a study of myths and language of the Navajo Indians. William Jones, a student and fellow of Columbia University, has returned from Oklahoma, where he has been conducting linguistic researches conjointly for the American Museum of Natural History and the Bureau of American Ethnology. Henry Minor Huxley has returned from his anthropological expedition in Syria.

THE Philippine Forestry Bureau has made a veritable raid on the professionally educated foresters in this country. The New York State College of Forestry has lost two of its senior students, Messrs. Clark and Klemme, who were sufficiently advanced in their studies to pass the Civil Service examination, and also Mr. Hagger, its forest manager from the College Forest, and its first graduate, who leaves a position with the New York State Forest, Fish and Game Commission. Captain Geo. P. Ahern, the chief of the Forestry Bureau, also secured the services of two other foresters, Messrs. Griffith and Hareford, and of Mr. S. N. Neely, a civil engineer, formerly employed by the United States Forestry Division in timber and physics work, to conduct a wood-testing laboratory. The crop of foresters promises to grow more rapidly in the future, the New York State College of Forestry having, this year, inscribed 38 students, and the students in the Yale Forest School, showing an increase of 22.

THE sixtieth birthday of Professor Hermann Nothnagel, the eminent pathologist of the University of Vienna, has been celebrated with appropriate ceremonies by his former students.

A TESTIMONIAL banquet, in honor of Dr. N. S. Davis, was given at Chicago on October 5. There were about 350 physicians in attendance and addresses were made by a number of well-known medical men and by Dr. Davis, who was presented with a cup. Dr. Davis, who was born January 19, 1817, took an important part in the reform of medical education in the United States. The American Medical Association was established at his initiative, and he was the first editor of its journal.

DR. SAMUEL J. JONES, professor of ophthalmology and otology at the Northwestern University Medical School, died October 4, aged

65 years. He was for many years editor of the *Chicago Medical Journal and Examiner*.

We regret to learn that Mr. Joseph S. Croswell, a graduate of the Massachusetts Institute of Technology and instructor in shop work and drawing at the Missouri School of Mines, as a result of emotional insanity, shot and killed Miss M. Powell, after which he committed suicide.

The death is announced of Major-General Alfred Wilkes Drayson, who was for many years professor of astronomy at Woolwich, England.

Dr. Max Reess, formerly professor of botany in the University at Erlangen, died on September 15, aged fifty-six years.

The Board of Directors of the Rockefeller Institute for Medical Research held a meeting in New York City on October 12. It was decided to award nineteen fellowships, the holders of which will work in established laboratories.

The Medical Society of the State of Pennsylvania met at Philadelphia on September 24, 25 and 26, under the presidency of Dr. Thomas D. Davis, of Pittsburg. Dr. F. P. Ball, of Lock Haven, was elected president for next year, and the meeting will be at Allentown.

The New York State Medical Association will meet in New York City, beginning on October 22.

We learn from the New York *Medical Record* that a conference of sanitary officers of the state of New York will be held at Albany on October 24 and 25. It will commence with an evening session on the twenty-fourth, which will be held in the Assembly Chamber of the capitol, and it is expected that the meeting will be addressed by Governor Odell. The next day there will be a morning and afternoon session, and the conference will close with a banquet in the evening at the hotel Ten Eyck. The object of this gathering is to afford an opportunity for meeting and making the personal acquaintance of the local and the central health authorities, and in a personal conference to present, by addresses and discussions, subjects and matters which are of practical and immediate interest to boards of health and their executive officers.

The Christmas Island Phosphate Company has given £1,000 to the Liverpool School of Tropical Medicine for a scientific expedition to investigate beri-beri, and has also given free transportation to the members of the expedition who left Cardiff on October 4. Sir John Murray and the Colonial Office have each contributed £100 in aid of the expedition.

Reuter's Agency reports that the Antarctic steamship, *Discovery*, on its way to Cape Town landed a party at South Trinidad, which remained six hours on the island. Messrs. Scott, Murray and Köttlitz ascended over 1,000 feet, obtaining some interesting natural history collections. Some new specimens of seaweed were obtained by towing a net while sailing, and were named after the *Discovery* and Mr. Scott.

Word has been received by Professor Osborn of the discovery of the entire side of the shell of a fossil *Glyptodon* by an expedition from the American Museum of Natural History in Texas. This animal looks more like a turtle than a mammal, the body being encased in a dome-shaped shell of bone, ornamented with an elaborate mosaic pattern. It has hitherto been known in this country by only two teeth and a few pieces of the shell, recorded by Professors Cope and Leidy in Texas and Florida in 1888 and 1889. The great shell found by the American Museum is four feet long, accompanied by the heavily armored tail, all beautifully sculptured and in perfect preservation. It is not a true *Glyptodon*, but more like the species *Hoplophorus* described by Lund from the bone caverns of Brazil. This specimen has been shipped to the Museum. It was found by one of the expeditions sent out especially for fossil horses.

The Peabody Museum of Harvard University has secured several large stone sculptures or old Mexican idols, stone faces, stone beads, etc., which were collected about forty years ago by a resident of Mexico.

The London correspondent of the New York *Evening Post* cables that a second consignment containing the later collections made by Sir Harry Johnston in East Africa has been received at the Natural History Museum. It in-

cludes four specimens of the five-horned giraffe, two males and two females, obtained on Mount Elgon. Expert opinion, however, has not yet pronounced this giraffe to be distinct from the form already known to occur in East Central Africa. Dr. Oldfield Thomas, the mammalogist of the Museum, is preparing a critical statement for the Zoological Society. The Royal Gardens at Kew have received an important series of plants collected by Sir Harry Johnston on the Ruwenzori mountain range, several species being new to botanical science.

IN Forest Park, the site selected for the exposition to be held in St. Louis in 1903, is a group of six circular mounds. In order that they may remain during and after the fair, steps should be taken by the scientific men of St. Louis to preserve them from destruction during the erection of the buildings. They would certainly form an interesting addition to the archaeological exhibit of the exposition equal in value to the space they occupy and would afterwards remain objects of permanent interest.

THE Director-in-Chief and other members of the staff of the New York Botanical Garden have extended an invitation to members and their friends to be present in Bronx Park on Saturdays, October 12, 19, 26 and November 2, 9 and 26. A train leaves Grand Central station at 2:15 p. m. for Bronx Park, and returning leaves Bronx Park at 5:38 p. m. Opportunity will be given for inspection of the museums, laboratories, library and herbarium, the large conservatories, the herbaceous collection, the hemlock forest, the fruticetum and parts of the arboretum site. The walk planned will be a little over one mile. The following lectures will be given at 4:30 p. m. :

October 12. 'Sunlight and vegetation,' by DR. D. T. MACDOUGAL.

October 19. 'Botany of the West Indies,' by DR. N. L. BRITTON.

October 26. 'Habits and characteristics of some of the larger marine plants,' by DR. M. A. HOWE.

November 2. 'Ancestral history of some living trees,' by DR. C. A. HOLLICK.

November 9. 'Production of cinchona bark and quinine in the East Indies,' by DR. H. H. RUSBY.

November 16. 'Botanical features of the mountains of Colorado,' by DR. L. M. UNDERWOOD.

UNIVERSITY AND EDUCATIONAL NEWS.

MRS. JAMES FINNEY HOW has given to Washington University the sum of $100,000 as a memorial of her father, the late James B. Eads. It has not yet been decided in what way this sum shall be used.

THE University and Bellevue Hospital Medical School has received an anonymous gift of $25,000.

COLUMBIA UNIVERSITY has received from Dean Lung a gift of $12,000 to be added to the endowment of $100,000 for the Chinese department given last June.

THE HON. OSCAR STRAUS has given to the University of Georgia a cabinet organ and several hundred dollars toward an equipment for work in experimental psychology.

MISS HELEN MILLER GOULD has given to Vassar College two scholarships of $10,000 each, for the benefit of graduates of the Tarrytown High School and of the Washington Irving High School at Irvington, N. Y.

THE new building for the Tufts College Medical School was opened on October 3, when Dr. Elmer T. Capen, president of the college, made the inaugural address.

THE Missouri School of Mines is now putting in a new heating plant and has in process of erection a building to be known as 'Mechanical Hall.' It will have two stories, 150 x 60 feet, and will be used for shop work and dynamo, steam and hydraulic laboratories. A second story is being added to the chemical laboratory, and it is being enlarged by two wings 55 x 60 feet each. One of these will be devoted entirely to assaying. An extension, 42 x 80 feet, to the ore-dressing and metallurgical laboratory, which has a floor space of 60 x 75 feet, will also be added, and plans have been made for a new main building. It will be three stories, with a basement well above ground, and 140 x 85 feet. The new site for this building has been purchased, consisting of eight acres immediately adjacent to the present campus, which contains about 20 acres. The present floor space of the school, devoted to laboratories, lecture rooms, etc., is 45,085 square feet. It will be on completion of the new buildings 126,848 square feet.

THE registration at the summer quarter of

the University of Chicago in the different groups was as follows: Philosophical-sociological 1,169, language and literature 2,544, divinity 788, education 1,602, sciences 1,128. The number of courses offered in the sciences and the registration were as follows:

Physical.		
Mathematics	14	317
Astronomy	3	40
Physics	11	191
Chemistry	14	195
Geology	8	124
Totals	50	867
Biological.		
Zoology	9	72
Anatomy	9	70
Physiology	2	33
Neurology	4	28
Botany	11	158
Totals	35	361

It is reported that restrictions will be placed on foreign students attending the Technical Institute at Charlottenburg. In Berlin, in Munich, and in other technical schools, there has recently been much complaint in regard to the number of foreign students. The restrictions are aimed especially against Russians, Americans being less numerous than formerly.

It is expected that a professorship of pathology will be filled at the University of Sydney at the close of the present year.

Dr. Roland Thaxter has been promoted to a professorship of cryptogamic botany at Harvard University.

Gilbert H. Boggs, A.B. (Georgia), Ph.D. (Pennsylvania), has been appointed instructor in chemistry in the University of Maine. W. C. Ebaugh, A.B. (Pennsylvania), Ph.D. (Pennsylvania) has taken the professorship of chemistry and physics in Kenyon College, Gambier, Ohio. Lily G. Kollock, A.B. (Woman's College), Ph.D. (Pennsylvania), has received an appointment in the Girls' High School, Louisville, Kentucky, as professor of chemistry and physics. Thomas M. Taylor, S.B. (Oberlin), Ph.D. (Pennsylvania), becomes instructor in chemistry in Oberlin College. Leonard P. Morgan, S.B. (Pennsylvania) has accepted an instructorship in chemistry in the Mining and Agricultural College, Stillwater, Oklahoma.

In the Medical College of Western Reserve University, Dr. F. C. Waite, of the University of Chicago, has been appointed assistant professor of histology and embryology, Dr. H. B. Parker demonstrator in pathology, and Dr. R. G. Perkins lecturer on bacteriology.

At the University of Pennsylvania, Dr. M. Howard Fussell has been appointed assistant professor of medicine, Dr. Thomas R. Neilson assistant professor of genito-urinary diseases, and Dr. Elisha H. Gregory, Jr., demonstrator of anatomy. Dr. Frederick A. Packard will deliver the lectures upon applied therapeutics, and Dr. H. C. Wood, Jr., those on the physiological action of drugs, in the place of Dr. Horatio C. Wood, professor of therapeutics, who has been granted leave of absence for a year.

At Washington University, Mr. A. P. Winston has been appointed instructor in political economy and Mr. A. O. Lovejoy, lately of Leland Stanford Junior University, has been appointed professor of philosophy.

Francis Gano Benedict, Ph.D., has been promoted to an associate professorship in chemistry, at Wesleyan University, Middletown, Conn.

Dr. Earl Barnes has been appointed a special lecturer in pedagogy in the School of Pedagogy of New York University.

Dr. A. A. Lawson, of the botanical staff of the University of California, who has spent the past year at Chicago (as fellow in botany), has been appointed assistant in botany at Leland Stanford Junior University.

Mr. H. T. A. Hus, M.S., a graduate student in botany at the University of California, has been appointed assistant in botany at the University of Amsterdam, Holland.

Dr. Hermann Simon, docent in physics at Frankfort a/M., has been appointed associate professor of physics and electricity in the University at Göttingen, and Dr. Ernst Neumann, docent in applied mathematics and physics in the University of Halle, has been appointed to an associate professorship in the University at Breslau. Dr. Julius Precht, associate professor of physics at Heidelberg, has been called to the Technical Institute at Hanover.